2003 REPORT TO CONGRESS
DISCLOSURE OF INFORMATION ON PROJECT 112 TO THE DEPARTMENT OF VETERANS AFFAIRS

As Directed By
PL 107-314

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EXECUTIVE SUMMARY

Public Law 107-314 requires the Department of Defense (DoD) to investigate and provide to the Department of Veterans Affairs (VA) medically relevant information concerning occupational exposures servicemembers may have received while participating in Projects 112 and Shipboard Hazard and Defense (SHAD). The law requires that DOD submit an investigation plan within ninety days of enactment and two progress reports, one six months after enactment and one upon completion of all activities contemplated by the investigation plan, but not later than one year after enactment. This is the second progress report required by section 709(e) of Public Law 107-314 and documents the completion of all activities contemplated by the investigation plan submitted pursuant to sections 709(a) and (b) of the same law.

The required investigation plan was submitted to Congress on March 20, 2003, although the DoD had begun working with the VA on this effort in August 2000. Because significant progress had already been made when Public Law 107-314 was enacted, the submitted plan was a summary of past investigative strategy, an outline of the remaining effort and a progress report of activities to date. In addition to listing the enormous number of documents the team had located and reviewed to that point, the progress report provided the remaining required information through examples of the web-based information products and tools that had been developed by the investigative team. At the time of the March 23, 2003, progress report, the investigative team could document that, of the 134 tests the Deseret Test Center is known to have planned between 1962 and 1973, at least 62 were cancelled and 46 were conducted. The execution status of the remaining 26 planned tests was not known.

This report is a comprehensive report. Over the past 34 months, the investigative team has located and reviewed over 28,000 pages of potentially relevant information. A list of all documents reviewed is included in this report. Of the 134 planned tests, 50 tests were conducted and 84 tests were cancelled. The medically relevant information for each conducted test has been declassified, provided to the VA, and summarized in a fact sheet. For those tests conducted in phases, a fact sheet has been prepared for each phase, making a total of 56 fact sheets. The fact sheets are publicly available on our web site and are included in this report. Twenty of the tests that the investigative team determined had been cancelled each required some explanation for that conclusion; those explanations are also available on our web site. For all ship-based tests with possible occupational exposures, crew rosters have been compiled and provided to the VA. For those land-based tests for which participating personnel information has been located, that information has also been passed to the VA. As of this report, a total of 5842 individual servicemembers have been identified as having participated in one or more of the Project 112 tests. A test-by-test count is included in this report.

Because the DoD investigation has found classified documents that identify the Deseret Test Center's planned, conducted and cancelled operational chemical and biological warfare tests during its existence from 1962 to 1973 and has provided the medically relevant information to the VA, the DoD has completed its contemplated actions under sections 709(a), (b) and (e) of Public Law 107-314. However, the Deployment Health Support Directorate within the Office of the Assistant Secretary of Defense (Health Affairs) will continue to respond to the questions, comments and concerns of veterans, Congress and the American public about the Deseret Test Center's activities

and will investigate any new information which may be presented. If that activity leads to any changes or additions to the information on Deseret Test Center activities, DoD will inform the VA, and appropriately modify the Deployment Health Support Directorate's SHAD/ Project 112/Deseret Test Center web site to inform the public.

DISCLOSURE OF INFORMATION ON PROJECT 112

This report is submitted pursuant to section 709(e) of the National Defense Authorization Act for Fiscal Year 2003, Public Law 107-314 and documents completion of Department of Defense activities contemplated by the investigation plan submitted pursuant to sections 709(a) and (b) of the same law. This law called for submission by the Department of Defense (DoD) to Congress and the Secretary of Veterans Affairs (VA) of a comprehensive plan for the review, declassification, and submittal to VA of all DoD information on Project 112 relevant to the provision of VA benefits to Project 112 participants, and then for a six-month progress report and final report upon completion of all activities contemplated by the comprehensive plan. The statute defines Project 112 as the chemical and biological weapons vulnerability testing program conducted by the Deseret Test Center from 1963 to 1969, including the Shipboard Hazard and Defense (SHAD) project.

HISTORICAL PERSPECTIVE

In 1961, Secretary of Defense Robert McNamara launched a wide-ranging assessment of how the Department of Defense (DoD) was organized and how the armed forces were structured and equipped to secure the nation. Of the approximately 150 sequentially numbered intensive studies undertaken, the 112th addressed chemical and biological warfare capabilities and defense.

Project 112 began during the early Cold War era when the United States faced a nuclear threat from both the Soviet Union and China. The Soviet Union was also suspected of having active chemical and biological warfare development programs. The United States considered chemical and biological warfare as an alternative to nuclear war. However, knowledge of nerve agent behavior in the field and operational decontamination in varying climates and terrain was limited. Despite extensive experimentation by the British and Japanese during Word War II, reliable biological agent weaponization had not been achieved. The effects of biological weapons in varying climates and terrain were also largely unexplored. Because DoD's knowledge of chemical and biological warfare agent behavior was so limited, a testing program was begun.

The U.S. Army was directed to establish a test center that would be staffed and funded by all the Services and would coordinate a joint test program. The Army established the Deseret Test Center at Fort Douglas, Utah, in June 1962. That location allowed test center personnel to take advantage of facilities and personnel at Dugway Proving Ground, Utah, to support tests, which were expected to be conducted in the Pacific Ocean or on land in Alaska, Hawaii and the then-Panama Canal Zone. From 1962 to 1973, the Deseret Test Center conducted a series of operational chemical and biological warfare tests in support of Project 112. Project SHAD (Shipboard Hazard and Defense) was a subset of that program. Much of the chemical and biological warfare agent behavior information collected then remains valid today.

The Deseret Test Center's testing objectives and priorities were established at a series of more-or-less annual joint planning conferences attended by representatives of the Services and Joint and Combatant Commands. The Center's biological testing program was significantly curtailed

after President Nixon's November 25, 1969, renunciation of biological weapons and limitation of research to "techniques of immunization and measures of controlling and preventing the spread of disease." A week earlier, passage and signature of Public Law 91-121 had inserted the then-Department of Health, Education and Welfare into the approval process for all open-air tests involving actual chemical or biological agents. A year later, the Clean Air Act of 1970 formally established guidelines on the release of substances into the air. By mid-1971, the Deseret Test Center's funding had been severely curtailed and it closed in 1973.

INVESTIGATION TIMELINE

Beginning in late 1991 and continuing for approximately five years, the Department of the Army, as DoD executive agent for chemical and biological matters, received and responded to several Congressional inquiries on behalf of three possible Project SHAD veterans. In 1992, the Army confirmed the existence of the Project SHAD program and provided, in relation to these specific inquiries, vessels involved, test locations and substances used. In a 1994 response, unclassified or redacted documents were also provided. In 1997 and 1998, there was renewed Congressional, Department of Veterans Affairs and media interest in release of additional information on the testing program. In August 2000, VA Acting Secretary Gober asked DoD to provide information concerning the Project SHAD tests. At the time of the request, information on three tests – *Autumn Gold*, *Copper Head* and *Shady Grove* – was needed to satisfy pending claims, but additional Project SHAD tests were believed to have occurred.

In September 2000, responsibility for the investigation was assigned to the organization now known as the Deployment Health Support Directorate (DHSD). Weekly meetings between the DoD investigative team leader and VA's compensation and health benefits managers ensured that the DoD team was searching for the specific information that the VA needed. That information included the dates and locations of the tests, the vessels involved, lists of the chemical and biological agents, simulants, tracer materials and decontaminants documented to have been used in the tests and rosters of the personnel aboard the vessels.

Investigators received some initial documentation from the Dugway Proving Ground technical library and, once the investigation expanded beyond the first three tests, searched for more in the archives of the Dahlgren Naval Surface Warfare Center. The first major hurdle was the discovery that 'SHAD,' while a valid umbrella term, was not commonly used at the time of the testing and thus was not a helpful search term. Investigators had to identify individual test names and numbers and use those as search criteria. Even with that information, document searches proved to be more difficult than expected because some of the tests had more than one name and/or test number.

When the investigation was expanded beyond the first three tests, DoD decided veterans of individual tests should not have to wait for a full report of the investigation. Investigators were instructed to prepare fact sheets for delivery to the VA and publication as soon as they had compiled and declassified the necessary information. The *Autumn Gold*, *Copper Head* and *Shady Grove* fact sheets were provided to the VA on September 13, 2001, and posted to the

DHSD Web site, DeploymentLINK, to inform the public. The *Autumn Gold* and *Copper Head* tests both used biological simulants; *Shady Grove* used biological warfare agents.

In a joint DoD/VA press conference on January 31, 2002, the *Eager Belle I and II* and *Scarlet Sage* fact sheets were released and were posted to the DHSD Web site to inform the public. Biological simulants were used in all three tests.

The *Flower Drum I and II*, *Fearless Johnny*, *Purple Sage*, *DTC Test 68-50*, and *DTC Test 69-32* fact sheets were released on May 23, 2002. The fact sheets were posted to the DHSD Web site to inform the public. The *Flower Drum* series and *Fearless Johnny* used chemical warfare nerve agents. *Purple Sage* was a chemical simulant test. *DTC Test 68-50* used biological warfare agent and *DTC Test 69-32* used biological simulants.

By this point, the investigation indicated that both shipboard and land-based testing were planned by the Deseret Test Center. The DoD committed to obtaining and providing to VA all medically relevant information and names of servicemembers present during all tests known to have been planned and conducted by the Deseret Test Center from 1962-1973. Document searches had already expanded to Aberdeen Proving Ground, Maryland, Fort Leonard Wood, Missouri, and several sites in the Washington, D.C., area. Investigators developed an understanding of the role the Deseret Test Center played in the planning and execution of the tests. A major breakthrough came with the discovery of several Deseret semi-annual and annual progress reports, which allowed a better understanding of the universe of tests being investigated.

In July 2002, Assistant Secretary of Defense for Health Affairs William Winkenwerder Jr., MD formed a task force committed to completing the search for documents and providing all medically relevant information to the VA by June 2003. To allow public oversight of the team's progress, a chart showing the current status of the investigation was posted to the DeploymentLINK Web site and continually updated. In late August 2002, the investigative team traveled to Dugway Proving Ground, Utah, where they located additional final test reports. The team also secured a complete set of annual planning conference reports, searched and retrieved relevant documents from paper archives, initiated actions to have fragile classified films copied to a more stabile media, and interviewed several former Deseret Test Center scientists.

In October 2002, DoD published 33 fact sheets based on newly discovered material from the Dugway, Utah, trip. Personnel information was provided to the VA in advance of a series of activities to communicate with Congress and the public. Publication of the fact sheets and posting the information to the DeploymentLINK Web Site followed a series of briefings to members of Congress and state delegations, Congressional testimony, and a joint DoD/VA press briefing. Fact sheets published included: *Whistle Down, Night Train, Tall Timber, West Side I, Magic Sword, Big Tom, Sun Down, Devil Hole I, High Low, Elk Hunt I, Elk Hunt II, Pine Ridge, Devil Hole II, Swamp Oak I, Green Mist, West Side II, Half Note, Dew Point, Red Cloud, Watch Dog, Rapid Tan, DTC Test 68-53, DTC Test 69-10, DTC Test 69-12, DTC Test 69-14, DTC Test 69-31, DTC Test 69-75, DTC Test 70-73, Big Jack A, Big Jack B, Yellow Leaf, Red Oak I and Pin Point.* Of the 33 fact sheets, 16 detailed the use of simulants and 17 detailed the use of live chemical or biological agents in the tests.

In December 2002, DoD released one additional fact sheet, *Cliff Rose*, and corrected a previously released fact sheet, *High Low*, based on information provided by several veterans. The information was provided to the VA and posted to the Web Site, DeploymentLINK, to inform the public. The investigative team intensified its search into obscure references to determine the status of the remaining tests.

Final declassification of medically relevant information on eight tests in June 2003 completed the public release of information on all known planned Deseret Test Center chemical and biological operational tests from 1962 to 1973. Fact sheets for three shipboard tests included *Errand Boy, Folded Arrow and DTC Test 70-C.* Seven fact sheets for five land-based tests included *Blue Tango, DTC Test 70-11 Phase I subtest 3, DTC Test 70-11 Phase I subtest 4, DTC Test 70-74, DTC Test 73-30, DTC Test 74-10 Phase I and DTC Test 74-10 Phase II.* The fact sheets were provided to the VA and posted to the Web site. Two of the shipboard tests – *Errand Boy* and *Folded Arrow*, used biological warfare agent simulants; one test – *DTC Test 70-C* – monitored naturally occurring airborne particulates in a marine atmosphere to gather background data. Of the five land-based tests, two used nerve agent simulants and three used biological simulants. The team also provided updated information on two tests; *Big Tom* and *Half Note*, based on recently located information and provided detailed analyses to explain why 20 tests were presumed to have been canceled.

Table 1. Released Fact Sheets

	New	Tests	Revised
September 13, 2001	3	3	
January 31, 2002	3	2	
May 23, 2002	6	5	
October 9, 2002	28	27	
October 31, 2002	5	4	
December 31, 2002	1	1	1
June 30, 2003	10	8	2
	56	**50**	**3**

The rosters of personnel aboard participating vessels were extracted from the ships' muster rolls and deck logs archived at National Archives II in College Park, Maryland. Lists of military personnel who participated in land-based tests have been assembled from available test officers' logbooks, temporary duty orders, country clearance messages, overtime reports, letters of commendation, and similar documents.

Personnel rosters for tests *Autumn Gold*, *Copperhead* and *Shady Grove* were provided to the VA beginning in March 2001. By release of the October 2002 fact sheets, personnel rosters were being passed prior to fact sheet publication to facilitate the VA's address acquisition process. Over 8800 records have been passed to the VA, documenting the participation of 5,842 individuals in one or more of the 50 tests.

Table 2. Summary of Personnel Information Flow to the VA

Date	No. of Records
March 2001	1535
July 2001	288
January 2002	1549
February 2002	11
May 2002	836
June 2002	126
July 2002	457
September 2002	891
October 2002	18
December 2002	433
January 2003	1275
February 2003	1
April 2003	7
June 2003	1415
	8,842 records
	5,842 individuals

No military personnel data were located for the following land-based tests: *Whistle Down, Big Jack A, Big Jack B, Night Train, Sun Down, Devil Hole I, Swamp Oak I, West Side II, Pin Point, Dew Point, Red Cloud, Watch Dog, Rapid Tan, Cliff Rose, DTC Test 68-53, DTC Test 69-12, DTC Test 69-14, DTC Test 69-75, DTC Test 70-11, DTC Test 70-73, DTC Test 70-74 and DTC Test 74-10.* No personnel data were reported to the VA for the shipboard test *Flower Drum II* because the target vessel was unmanned. No personnel data were reported to the VA for the shipboard test *DTC Test 70-C* because this test only collected air samples of naturally occurring airborne particulates while traveling from San Diego to Panama. No agents or simulants were released.

The purpose of this investigation was to locate information concerning possible exposures to military personnel. During the course of its work, the investigative team did locate documentation substantiating the participation of approximately 350 government civilian employees and contractor personnel.

In its search for medically relevant information, the investigative team has contacted and/or visited every command and government research activity known to have been affiliated with the Deseret Test Center. In general, the type of records found were technical reports on tests plans and results. Such reports were and are classified for national security reasons because information on dissemination characteristics of, and operational countermeasures to, chemical and biological agents and simulants for those agents could be used by adversaries or terrorist organizations with chemical or biological weapons program ambitions. However, without compromising national security information, the identification of agents or simulants, tracers and decontaminants used in tests can be declassified and released in fact sheets to answer questions about veterans' exposures under Project 112. Fact sheets have been published, which meet the VA's criteria for the information needed to evaluate compensation claims and health care needs.

The DHSD will continue to cooperate with the VA should additional information be needed for the purposes of detailed epidemiological studies. Although we have conducted an exhaustive search for information pertinent to possible VA benefits for Project 112 veterans, we cannot agree that any degree of searching records archives of a long ago terminated program would result in complete current documentation of all aspects of the program. Nonetheless, we believe the evidence found produces an accurate total picture of the Deseret Test Center program. We know of no other investigative leads that would meaningfully supplement that picture. However, the DHSD will investigate any new information that may be presented and share any additional or changed information with the VA and the public.

In DoD's investigation, no test-specific medical records or classified medical records were found. Technical reports on tests did not include personally identifiable information on health effects of exposures. The purpose of the tests was not to measure health effects; the purpose was to assess dissemination characteristics and operational countermeasures. Confirming reports from some veterans that in some tests nasal swabs and gargle samples were taken, one test report records results from nasal swab and gargle samples of several individuals, but these results did not include personal identifiers that would tie the results to specific individuals or produce information for medical records. These samples taken from individuals were to test the comparative filtering effects of different types of gas masks. In relation to other tests, several references to possible health surveillance activities and protective measures were also found in technical reports of test plans or results, matters presumably documented, to the extent they actually occurred, in members' individual medical records. We found an indication that in the 11-year history of the Deseret Test Center program there were four infections and no deaths. We found no other information connecting this notation, which might involve Deseret Test Center laboratory workers, to any particular Project 112 test or tests. We found no personally identifiable information on illnesses or medical treatments.

Review of the operational test planning documents and final test report documents and discussions with several of the scientists who planned and conducted these tests have provided substantiation that whenever harmful chemical or biological warfare agents were used as test substances, personnel present were appropriately protected. Actual exposure to such agents would result in acute health effects. However, when chemical or biological simulants or tracer materials were used, there were no efforts made to protect personnel because those substances were not believed to be harmful. For the shipboard operational testing, we have reviewed the ships' deck logs and have not found any indication of acute medical problems (deaths, medical evacuations, or numerous crewmembers becoming ill) at the time of this testing or immediately afterwards. This is also the case for those land-based tests for which we have located test officers' logs. In addition, neither the final test reports nor the Deseret Test Center scientists we talked with indicated any acute medical problems arising from participation in the series of tests we reviewed. Many of the chemical simulants that were used by the Deseret Test Center continue to be used as chemical simulants today. Only one of the biological simulants – *Bacillus subtillis var. niger* (*Bacillus globigii*) – continues to be used as a biological simulant for operational testing today. The other biological simulants have been replaced with agents having a lower risk of causing acute infections in immuno-compromised individuals. The decontaminants used were recognized to have acute effects on people if proper precautions were not taken; however, these substances are still being used today.

The Institute of Medicine, Medical Follow-up Agency, has been contracted to conduct a study of the current health of those sailors who were present during Shipboard Hazard and Defense (SHAD) testing and to compare their health status with sailors of the same period who were on similar ships which did not participate in operational chemical and biological testing. The results of this study should be concluded in 2005.

Although the information available does not suggest a pattern of illness or disability attributable to Project 112/SHAD participation, DoD believes the information that has been found, declassified, and released will greatly assist both further assessment of the entire project, such as the IOM study, and further analysis of individual veteran's disability claims. For thousands of veterans, the VA will now be able to confirm participation in SHAD and make a determination about exposure to a particular substance of substances. If scientific evidence supports a cause and effect link between such exposure and a disabling illness, the elements needed for a disability compensation award or other veterans benefits will all be established.

The DHSD hears from Project 112 veterans almost daily. Many of those veterans have sent copies of documents that have helped the investigation. Every veteran's account has been heard and factored into the investigation. Their recollections and personal documents have been very helpful in filling in the gaps in the official record.

A COMMENDATION TO PROJECT 112 VETERANS

The Department of Defense wishes to acknowledge the patriotic service of all who participated in the Project 112 program. Publication of this report summarizes a significant effort on the part of many people in the Department of Defense to ensure important information has been made available to service members and the Department of Veterans Affairs. DoD understands that some Project 112/SHAD veterans feel this investigation should have been conducted and the information provided years ago, and hopes that the efforts summarized in this report are responsive to their concerns. This in-depth investigation reflects an individual and collective commitment to veterans and their families to help bring closure and to replace speculation and uncertainty with fact.

WHAT WE KNOW TODAY

The Deseret Test Center planned 134 operational tests in support of Project 112. Fifty were conducted and 84 canceled. Table 3 shows the distribution of land- and sea-based (SHAD) tests.

Table 3. Distribution of Project 112 tests

	Project 112	Land-based	Project SHAD
Planned	134	90	44
Conducted	50	31	19
Canceled	84	59	25

Approximately half of the Project SHAD tests were conducted in the open ocean. The remaining tests were conducted in the coastal waters of California, Hawaii, Puerto Rico and the Marshall Islands. Table 4 shows the locations of the 19 completed Project SHAD tests.

Table 4. Location of Project SHAD Tests

Atlantic Ocean	1
Vieques, Puerto Rico	1
Pacific Ocean	13
Baker Island	1
Off Hawaiian Islands	3
Off San Diego	5
Open Ocean	4
Oahu, Hawaii	3
Entire Island	2
Pearl Harbor	1
Marshall Islands	1
Total	**19**

Approximately two-thirds of the Project 112 land-based tests were conducted outside the continental United States. Half of those were conducted in Alaska because the test sites could be used under both temperate and arctic conditions. Most of those conducted in the continental United States were conducted at Dugway Proving Ground, Utah. Table 5 shows the primary locations of the 31 completed land-based tests; some tests conducted a portion of their trials at other listed test sites.

Table 5. Primary location of Project 112 land-based tests

Alaska	11
Florida	1
Hawaii	4
Georgia	1
Maryland	1
Utah	7
Canada	1
Canada and Great Britain	1
Panama	3
Unspecified	1
Total	**31**

Test documentation lists 21 Navy and Army vessels as participating in one or more Project SHAD tests. These vessels are listed in Table 6.

Table 6. Participating vessels

USNS *Silas Bent*
USS *Berkeley*
USS *Carbonero*
USS *Carpenter*
USS *George Eastman*
USS *Fechteler*
USS *Granville S. Hall*
USS *Hoel*
USNS *Samuel Phillips Lee*
USS *Navarro*
USS *Okanogan*
USS *Power*
USS *Fort Snelling*
USS *Herbert J. Thomas*
USS *Tioga County*
USS *Wexford County*
LT2080
LT2081
LT2085
LT2086
LT2087

The fact sheets for each test identify the substances used in that particular test. Summarized below are the substances documented to have been used in one or more of the Project 112 tests along, with their known health effects.

Warfare Agents

Chemical Agents:

Tabun (GA). Tabun is an amber, non-persistent liquid, which gives off little odor when vaporizing. The vapor is colorless. When exposed to Tabun, the first symptoms a victim will experience are a runny nose, tightness in the chest and dilation of the pupils. The victim will then encounter difficulty breathing, drooling from the mouth and nausea. Ultimately the victim will become comatose and will suffocate as a consequence of convulsive spasms. Tabun is essentially absorbed through the skin; however, vapors can also be hazardous. If a person does not receive an immediate lethal dose, death will occur after approximately 20 minutes. Those receiving a less than lethal dose who do not receive immediate medical care may suffer permanent neurological damage. There is little information available regarding the long-term human health effects of exposure to low does of tabun. [Stockholm International Peace Research Institute at *http://www.cbw.sipri.se/docu/cw-agents/tabun.html*]

Sarin (GB). Sarin is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, symptoms may occur within minutes and include runny nose, watery eyes, difficulty

breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. An Institute of Medicine Committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term health effects. [Centers for Disease Control at *http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp*]

Soman (GD). Soman is a colorless liquid, which gives off an odor of rotting fruit when vaporizing. The vapor is colorless. Soman is a persistent agent that can easily remain in a particular area for a day or longer, depending on the atmospheric conditions. Symptoms associated with exposure to Soman include a runny nose, tightness in the chest and constriction of the pupils. These symptoms are followed by difficulty in breathing. Ultimately the victim will become comatose and suffocate as a consequence of convulsive spasms. There is little information available regarding the long-term human health effects of exposure to soman. [Stockholm International Peace Research Institute at *http://www.cbw.sipri.se/docu/cw-agents/soman.html*]

VX. VX nerve agent is extremely lethal. It is an oily liquid that is clear, odorless, and tasteless. Death usually occurs within 10-15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: constriction of pupils, headaches, runny nose, salivation, tightness in the chest, nausea, vomiting, anxiety, difficulty in thinking, muscle twitches, tremors, and weakness. With severe exposure, symptoms progress to convulsions and respiratory failure. There is little information available regarding the long-term human health effects of low doses of VX. [Centers for Disease Control and Prevention at http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp or World Health Organization, Department of Sustainable Development & Environmental Protection http://209.61.192.180/phe/factsheet5.htm.]

Ester of Benzilic Acid (Agent BZ) (3-quinuclidinic ester of benzilic acid). Agent BZ is a psychochemical compound designed for temporarily disabling an enemy. It is designed to cause stupor, confusion and hallucinations when inhaled or absorbed through the skin. It is a white powder and may cause eye and skin irritation. Agent BZ may also irritate the digestive and respiratory tracts, if inhaled or ingested. While some effects may last several days or weeks, long-term or late-developing health effects have not been documented and seem unlikely. [http://www.fishersci.ca/msds.nsf or http://www.fas.org/nuke/guide/russia/cbw/jptac008_194001.html]

Biological Agents:

Coxiella burnetii (OU). This microorganism (a rickettsial species) can cause acute and chronic infection of the lung, liver, heart valve, nervous system, and other body sites (Q fever). Complications from this infection may be serious, even life threatening, but late-developing health effects would be unlikely. [Chin J, ed., Control of Communicable Diseases in Man, American Public Health Association, Washington DC, 2000, p. 407-11; Marrie, Thomas J., in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), Churchill Livingstone, Philadelphia, 2000, p. 2043-50]

Francisella tularensis (TT and ZZ). Formerly identified as *Pasteurella tularensis*, this bacterial species can cause acute infection of the lung, bloodstream, and other body sites (tularemia), and is considered a potential biological warfare agent. While complications of the acute infection may be serious, even life threatening, long-term or late-developing health effects would be very unlikely. [Cross, J et al., in *Principles and Practice of Infectious Diseases,* 5th edition (vol. 2), Mandell GL, Bennett JE, Dolin R, eds., Churchill Livingstone, Philadelphia, 2000, p. 2393-2402; and Dennis DT et al., JAMA 2001;285(21):2763-73]

Puccinia graminis tritici (TX). This fungal species is toxic to plants, and therefore was considered a potential biological warfare agent directed against agricultural crops. It is not ordinarily considered to have either short-term or long-term human health effects. [Zajtchuk R., ed., Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997, p. 60, 460; and web site at *http://www.cbwinfo.com*]

Staphylococcal enterotoxin B (PG2). When inhaled, this bacterial toxin can cause fever and cough, incapacitation, and (with large doses) death, and is considered a potential biological warfare agent. When ingested, it commonly causes gastrointestinal symptoms (nausea, vomiting, and diarrhea). Some symptoms may last weeks, but long-term or late-developing health effects would be unlikely. [Ulrich RG et al., in Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997, p. 621-30]

Riot Control Agents:

CS and CS2. Two of several chemicals commonly called "Tear Gas." CS and CS2 are white, crystalline powders dispersed into the air as either an aerosol or powder. The chemical name for CS and CS2 is ortho-chlorobenzylidene malononitrile. Riot control agents affect the eyes, airways and skin. Exposure to CS causes burning, irritation, tearing and pain in the eyes. Airway symptoms include burning, sneezing, cough, shortness of breath and increased secretions, such as runny nose and increased salivation. High concentrations of CS or CS2 can cause blistering of the skin. With commonly used concentrations, these effects are short-term and the potential for long-term health consequences is low.
[http://www.metrokc.gov/health/hazard/riotcontrol.htm#cs and Cornell University, http://msds.pdc.cornell.edu/msds/siri/files/chl/chlfz.html]

Simulants

Chemical Simulants:

Bis (2-ethyl-hexyl) hydrogen phosphite. This chemical compound used as an additive in industrial lubricants can cause acute irritation of the skin, eyes, and respiratory tract. There is insufficient evidence for or against long-term health effects. [NLM TOXNET at *http://toxnet.nlm.nih.gov.*]

Di (2-ethylhexyl) phthalate (DEHP). This chemical is commonly present in flexible plastics and therefore widespread in the environment and of some concern for the general population. While low level exposures have not been shown to cause serious health effects, acute exposure to high levels of this chemical can cause irritation of the skin, eyes, and respiratory tract. DEHP has caused cancer in some animal testing, but the relevance of this testing to cancer in humans is uncertain. [DHHS PHS ATSDR ToxFAQs, Di(2- ethylhexyl)phthalate #117-81-7, April 1993, and Toxicological Profile for Di(2-ethylhexyl)phthalate (DEHP), September 2000, both available at *http://www.atsdr.cdc.gov*. Also WHO International Agency for Research on Cancer (IARC) Monographs on the Evaluation of Carcinogenic Risks to Humans (vol. 77, Some Industrial Chemicals updated February 23, 2000), and NLM TOXNET, Bis(2-ethylhexyl)phthalate 117-81-7 Human Health Effects, available at *http://toxnet.nlm.nih.gov*]

Diethyl phthalate. This chemical is commonly present in flexible plastics and cosmetics as well as in some insecticides and repellents, and therefore widespread in the environment and of some concern for the general population. While low level exposures have not been shown to cause serious human health effects, acute exposure to high levels of this chemical can cause irritation of the skin and eyes in animal testing. It is mutagenic and carcinogenic in some cell and animal testing, but these effects have not been demonstrated in humans. [DHHS PHS ATSDR ToxFAQs, Diethyl Phthalate #84-66-2, September 1996, and Toxicological Profile for Diethyl Phthalate, both available at *http://www.atsdr.cdc.gov*. Also NLM TOXNET, Diethyl Phthalate 84-66-2, HSDB Human Health Effects and Animal Toxicity Studies, as well as CCRIS, IRIS and other databases, all available at *http://toxnet.nlm.nih.gov*]

Dimethyl methylphosphonate (DMMP). Dimethylmethylphosphonate is used as a flame retardant, a pre-ignition additive for gasoline, an antifoam agent, a plasticizer and stabilizer, a textile conditioner and anti-static agent, and an additive for solvents and low-temperature hydraulic fluids. It may be harmful if inhaled, swallowed or absorbed through the skin. It is a suspected carcinogen. [*http://ntp-server.niehs.nih.gov/htdocs/LT-studies/tr323.html*]

Polymethyl methacrylate (PMMA). Polymethyl methacrylate is a clear plastic used as a shatterproof replacement for glass. It is also found in acrylic latex paints. Little is known about long-term health effects of PMMA, but methyl methacrylate (from which PMMA is made) is considered not likely to be carcinogenic to humans. [EPA, Toxicological review of methyl methacrylate (CAS No. 80-62-6), January 1998, available at *http://www.epa.gov*, and NLM TOXNET, methyl methracrylate, HSDB Human Health Effects, available at *http://toxnet.nlm.nih.gov*]

Methylacetoacetate (MAA). While acute exposure to this compound has been associated with irritation of skin, eyes, respiratory tract, and digestive tract, there is little or no evidence of long-term or late-developing health effects and it is not known to cause cancer in animal testing. [NLM TOXNET, Methyl acetoacetate 105-45-3, HSDB Human Health Effects and Animal Toxicity Studies, available at *http://toxnet.nlm.nih.gov*]

Sulfur Dioxide (SO2). This compound is a common product of combustion and an environmental air pollutant. Acute exposure to high levels of sulfur dioxide can cause burning of the nose and throat, difficulty breathing, and even obstruction of the airways. Long-term

exposures have been associated with breathing difficulty and lung damage. Even low level exposures may worsen asthma. It can cause cancer in some animal species, but this has not been clearly demonstrated in humans. [DHHS PHS ATSDR ToxFAQs, Sulfur dioxide #7446-09-5, June 1999, available at *http://www.atsdr.cdc.gov*]

Trichloropropane. This chemical is used as an industrial solvent, paint and varnish remover, and cleaning and degreasing agent. Exposure to high levels for a short time causes eye and throat irritation. [*http://www.atsdr.cdc.gov/tfacts57.html http://www.osha-slc.gov/fts/chemicalsmapling/data/CH_273200.html*]

Trioctyl phosphate (TOF). Used as a simulant for VX nerve agent. This compound, also known as tri(2-ethylhexyl) phosphate, can irritate the eyes, skin, and respiratory tract on contact. It can cause cancer in some animal species, but this has not been demonstrated in humans. [NLM TOXNET, Trioctyl phosphate 1806-54-8 or Tris(2-ethylhexyl)phosphate 78-42-2, HSDB Human Health Effects and Animal Toxicity Studies, available at *http://toxnet.nlm.nih.gov*]

Biological Simulants:

Bacillus globigii (BG). Now considered to be a variety or close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late developing health effects would be very unlikely. [Tuazon CU in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6, and US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at *http://www.epa.gov*]

Escherichia coli (E. coli). This bacterial species is a common inhabitant of the digestive tract but can also cause acute infection, especially when it gains access to other body sites, like the urinary tract, lung, and bloodstream. Long-term or late-developing health effects of E. coli infection would be unlikely. [Eisenstein, Barry I.et al, in *Principles and Practice of Infectious Diseases*, 5th edition (vol. 2), Churchill Livingstone, Philadelphia, 2000, p. 2299-301.]

Serratia marcescens (SM). This bacterial species can cause acute infections of the urinary tract, lung, bloodstream, and other body sites. These infections commonly occur in individuals whose health has already been compromised, and often in patients who are already hospitalized. Long-term or late-developing health effects would be very unlikely. Its use as a bacterial marker for studying the dissemination of bacterial aerosols was discontinued in 1969. [Eisenstein, BI et al., in *Principles and Practice of Infectious Diseases* (chap. 206), 2000]

T-3 coliphage. Coliphages are viruses (bacteriophages) that infect *E. coli* bacteria and would not be expected to have harmful effects on humans. [*http://www.epa.gov/nerlcwww/1601ap01.pdf*]

Other Substances

Tracer Materials:

Calcofluor (fluorescent brightener 28). Used as a fluorescent tracer with *Bacillus globigii*. This chemical has been used as a medical laboratory stain and as a whitening agent in detergents. It can cause eye irritation in animal testing, but there is limited evidence for or against human health effects. [NLM TOXNET, Cellufluor 4193-55-9, available at net.nlm.nih.gov, and MSDS available at *http://hazard.com*]

Phosphorous 32. One of the highest-energy beta-emitting radionucleotides commonly used in biomedical research. In general Phosphorous 32 does not pose a severe threat from ingestion or inhalation. High-energy betas from Phosphorous 32 pose an external (skin and lens of the eye) dose hazard as well as a potential internal hazard. Radiogenic health effects (primarily cancer) are observed in humans only in doses in excess of 10 rem delivered at high dose rates. Below this dose, estimation of adverse health effects is speculative. Exposure can contribute to development of cancer. [*http://www.uos.harvard.edu/ehs/radsafety/gui_p32.shtml*]

Tiara. A luminescent gelatinous material. No other information is available.

Uranine. This chemical compound is added to cosmetics for color and is commonly used (injected or applied) for medical diagnostic purposes (e.g., for vascular imaging and eye staining). It can cause acute skin reactions and acute allergic reactions (including life-threatening anaphylaxis) in some individuals. Long-term and late-developing health effects would be very unlikely. [NLM TOXNET, Fluorescein Sodium 518-47-8 and Fluorescein 2321-07-5, available at *http://toxnet.nlm.nih.gov*]

Zinc cadmium sulfide (ZCdS). This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and duration of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low. [National Research Council (National Academies), Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion]

Decontaminants:

Betapropiolactone (β-Propiolactone). This chemical is a disinfectant. Modern uses for β-propiolactone include vaccines, enzymes, tissue grafts, and surgical instruments; to sterilize blood plasma, water, milk, and nutrient broth; and as a vapor-phase disinfectant in enclosed spaces. Its sporicidal action kills vegetative bacteria, pathogenic fungi, and viruses. The primary routes of potential human exposure to β-propiolactone are inhalation, ingestion, and dermal

contact. Acute contact can cause skin, eye, and respiratory tract irritation, sometimes with permanent damage. An International Agency for Research on Cancer (IARC) working group reported no data are available to evaluate the carcinogenicity of β-propiolactone in humans. It is carcinogenic and mutagenic in animal and bacterial cell testing. [Department of Health and Human Services, National Institutes of Health web site at http-server.niehs.nih.gov; EPA Technology Transfer network Air Toxics Website, at *http://epa.gov*, and NLM TOXNET, at *http://toxnet.nlm.nih.gov*]

Calcium hypochlorite. Uses for calcium hypochlorite include bleach, cleaning solutions, and disinfectants for drinking water, wastewater purification systems, and swimming pools. When released into the air, it is broken down by sunlight and compounds commonly found in the air. Ingestion of small amounts can cause gastrointestinal irritation. Larger amounts can cause corrosive injuries to the mouth, throat, esophagus, and stomach and can be life threatening. Inhalation of chlorine gas may cause nasal irritation, sore throat, and coughing. Contact with the skin may cause burning pain, inflammation, and blisters. The International Agency for Research on Cancer (IARC) has determined that hypochlorite salts are not classifiable as to their carcinogenicity in humans. [ATSDR Medical management guidelines for calcium hypochlorite and sodium hypochlorite, available at *http://www.atsdr.cdc.gov*]

Monoethanolamine. This chemical causes eye and skin burns, may be harmful or fatal if swallowed, may cause dizziness and drowsiness, and causes respiratory tract irritation and possibly damage. Chronic exposure to skin may cause a persistent irritation or dermatitis. Repeated inhalation may cause lung damage. [*http://www.astrochemicals.com/10129.pdf*]

Other:

Aedes aegypti mosquitoes. *Aedes aegypti* mosquitoes used in this test were not infected. Health effects at the time would be the usual swelling and irritation associated with mosquito bites. No long-term or latent effects would be expected.

NUMBER OF RECORDS REVIEWED

What follows is a list of all records reviewed by the Deployment Health Support Directorate's investigative team and retained for use by it investigators. This list reflects more than 28,000 pages reviewed by DoD's investigators. Prior to the passage of Public Law 107-314, DoD's investigators did not catalog the record they records reviewed unless they were retained for investigator use. To date, we estimate that the investigative team has reviewed approximately 10,000 additional pages of records and determined that the material was not germane to this investigation.

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Document Title	# of pages	clas
A Project Summit Report - Task Night Train Arctic Test Technology for Biological Weapons 31 July 1963	99	CONF
Additional Calculations for Project Big Tom (U)	12	CONF
An Overview of the Deseret Test Center Support and Technical Facilities, October 1972	89	FOUO
Analytical Study Vulnerability of the US and its military forces to antipersonnel biological attack	55	SECRET
Analytical Study Vulnerability of the US and its military forces to antipersonnel biological attack	145	SECRET
Annual Status Report of Joint Operational Activities	46	SECRET
Annual Status Report of Joint Operational Activities, March 1971	30	SECRET
AUTUMN GOLD Test 63-2 Final Report May 1964	85	CONF
Bibliographic Data received from Dugway Proving Ground, UT technical library	326	UNCLAS
Bibliographic Data received from Edgewood technical library	102	UNCLAS
BIG JACK Phase A Final Report May 1964	198	CONF
BIG JACK Phase B Final Report May 1964	154	CONF
Biological and Chemical Ship Penetration 8 June 1965	14	CONF
Biological and Ship Penetration 8 June 1965	10	CONF
Biological Defense Research Vulnerability of a Naval Amphibious task Force to attack by Biological Agents Technical Report	47	SECRET
Brief Summary of DTC Bio Tests, 17 February 1977	22	SECRET
Chemical Weapons in Russia: History, Ecology, Politics 1994	72	UNCLAS
Chronological History of Ernest Harmon Air Force Base	7	UNCLAS
Climatological Survey of Areas of Interest to Ai-personnel BW	88	SECRET
Combat Lady (U)	153	CONF
Combat Lady (U)	157	CONF
Comparison of Penetration During COPPER HEAD versus Penetration During HIGH LOW December 1965	10	CONF

Conference Briefs for the Fourth Annual Deseret Test Center Planning Conference, 8 March 1965	122	SECRET
Coordination Draft of Test 65-16 PINE RIDGE Final Report June 1967	84	SECRET
COPPER HEAD Special Exercise Report 23 March 1965	22	UNCLAS
COPPER HEAD Test Plan September 1964	71	CONF
Critique of DTC Biological Proposed Testing Outline Plans for Testing in Fiscal Year 1969, Volume I, 15 August 1967	43	CONF
Critique of DTC Biological Proposed Testing Outline Plans for Testing in Fiscal Year 1969, Volume II, 15 August 1967	45	CONF
Critique of DTC FY 71-A and B	35	CONF
Critiques of proposed test plans, tests, 70-30, 70-70, 70-31, 70-71, 70-72, 70-73, 70-74	60	CONF
Daily Test Log DTC Programs Pine Ridge, Tall Timber and yellow Leaf	80	CONF
Decision Risk Analysis on Biological Defense Program	92	CONF
Decision Risk Analysis on Biological Defense Program	65	CONF
Deck Log Book, USS Carpenter (DD-825), June 1963	14	UNCLAS
Deck Log Book, USS Carpenter (DD-825), May 1963	47	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), April 1965	33	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), April 1966	40	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), August 1963	33	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), August 1965	51	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), August 1966	38	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), December 1963	37	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), December 1966	32	UNCLAS

Deck Log Book, USS George Eastman (YAG-39), February 1963	33	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), February 1964	59	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), February 1965	49	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), February 1966	31	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), February 1967	30	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), January 1963	71	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), January 1964	63	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), January 1965	57	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), January 1966	33	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), January 1967	32	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), July 1966	33	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), June 1964	61	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), June 1966	31	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), March 1963	63	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), March 1964	63	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), March 1965	36	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), March 1966	47	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), March 1967	32	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), March 1967	35	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), May 1964	64	UNCLAS

Deck Log Book, USS George Eastman (YAG-39), May 1966	38	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), November 1963	21	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), November 1964	37	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), November 1965	31	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), November 1966	33	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), October 1963	35	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), October 1966	32	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), September 1965	54	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), September 1966	34	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), April 1964	13	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), April 1965	16	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), April 1967	39	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), April 1969	29	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), August 1964	1	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), August 1965	20	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), August 1966	47	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), December 1965	18	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), December 1966	17	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), February 1963	29	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), February 1964	34	UNCLAS

Deck Log Book, USS Granville S. Hall (YAG-40), February 1965	34	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), January 1963	5	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), January 1964	51	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), January 1965	12	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), July 1964	13	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), July 1966	42	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), June 1963	14	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), June 1964	9	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), June 1965	26	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), June 1966	34	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), June 1967	33	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), June 1969	29	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), March 1963	63	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), March 1964	55	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), March 1965	36	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), May 1963	66	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), May 1964	36	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), May 1965	24	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), May 1966	39	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), May 1967	42	UNCLAS

Deck Log Book, USS Granville S. Hall (YAG-40), May 1969	41	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), November 1965	21	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), November 1966	31	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), October 1964	25	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), October 1966	40	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), September 1963	32	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), September 1964	6	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), September 1965	34	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), September 1966	55	UNCLAS
Deck Log Book, USS Herbert J. Thomas (DD-833), February 1966	42	UNCLAS
Deck Log Book, USS Herbert J. Thomas (DD-833), January 1966	47	UNCLAS
Deck Log Book, USS Herbert J. Thomas (DD-833), March 1966	39	UNCLAS
Deck Log Book, USS Hoel (DDG-13), May 1963	35	UNCLAS
Deck Log Book, USS Navarro (APA-215), June 1963	20	UNCLAS
Deck Log Book, USS Navarro (APA-215), May 1963	67	UNCLAS
Deck Log Book, USS Power (DD-839), February 1965	43	UNCLAS
Deck Log Book, USS Power (DD-839), January 1965	48	UNCLAS
Deck Log Book, USS Tioga County (LST-1158), June 1963	23	UNCLAS
Deck Log Book, USS Tioga County (LST-1158), May 1963	73	UNCLAS
Defenses Against Biological Attack: A General Assessment	71	SECRET
Defenses Against Biological Attack: A General Assessment	110	SECRET

Department of the Army Correspondence (10 Docs) - SHAD declassification	14	UNCLAS
Deseret Test Center Final Report Test 63-1 EAGER BELLE Phase I (Revised) 30 June 1965	106	SECRET
Deseret Test Center in 1962, January 1963	28	CONF
Deseret Test Center Log for Shad Tests (Autumn Gold and Devil Hole), 17 May 65-10 Sept 65	49	UNCLAS
Deseret Test Center Outline Plans for FY 75, February 1973	43	SECRET
Deseret Test Center Report DTC 64-342, Five Year Testing Program, Extra-continental Testing Program for Chemical and Biological Weapons and Defensive Systems, 1 April 1964	46	CONF
Deseret Test Center Requirements and Proposed Program for FY 74, November 1972	90	SECRET
Deseret Test Center Test Plan 63-2 Revision 1 AUTUMN GOLD April 1963	96	CONF
Deseret Test Center Test Plan DTCP 63-1 EAGER BELLE Phase II December 1962	57	CONF
Deseret Test Center Test Plan DTCP 63-4 BIG JACK November 1962	80	CONF
Deseret Test Center Test Plan DTCTP 63-1 EAGER BELLE Phase 1 October 1962	78	CONF
Deseret Test Center Test Plan Test 64-6 YELLOW LEAF 14 January 1964	66	CONF
Deseret Test Center, Film Inventory	13	SECRET
Deseret Test Center, Outline Plans for FY 74, March 1972	102	SECRET
Deseret Test Center, Outline Plans for Testing in FY 64, 19 February 1963	59	CONF
Deseret Test Center, Outline Plans for Testing in FY 65, December 1963	90	CONF
Deseret Test Center, Outline Plans for Testing in FY 66, 16 December 1964	47	CONF
Deseret Test Center, Outline Plans for Testing in FY 66, Supplement I, 17 December 1964	35	CONF
Deseret Test Center, Outline Plans for Testing in FY 66, Supplement II, January 1966	17	CONF
Deseret Test Center, Outline Plans for Testing in FY 67, December 1965	51	CONF

Deseret Test Center, Outline Plans for Testing in FY 67, Supplement I, December 1965	30	CONF
Deseret Test Center, Outline Plans for Testing in FY 67, Supplement II, February 1966	21	CONF
Deseret Test Center, Outline Plans for Testing in FY 68, January 1967	39	CONF
Deseret Test Center, Outline Plans for Testing in FY 68, Supplement 4, January 1967	38	CONF
Deseret Test Center, Outline Plans for Testing in FY 68, Supplement I, January 1967	28	CONF
Deseret Test Center, Outline Plans for Testing in FY 68, Supplement II, January 1967	33	SECRET
Deseret Test Center, Outline Plans for Testing in FY 68, Supplement III, January 1967	30	CONF
Deseret Test Center, Outline Plans for Testing in FY 69, January 1968	56	SECRET
Deseret Test Center, Outline Plans for Testing in FY 69, Supplement I, January 1968	41	SECRET
Deseret Test Center, Outline Plans for Testing in FY 69, Supplement II, January 1968	26	SECRET
Deseret Test Center, Outline Plans for Testing in FY 69, Tests for Special Consideration, January 1968	29	SECRET
Deseret Test Center, Plans for Testing in FY 70, February 1969	74	SECRET
Deseret Test Center, Plans for Testing in FY 70, Supplement I, February 1969	75	SECRET
Deseret Test Center, Requirements and Proposed Programs for FY 73, October 1971	53	SECRET
Deseret Test Center, Semi-Annual Status Report, Current Activities to 15 February 1966	117	CONF
Deseret Test Center, Semi-Annual Status Report, Current Activities to 15 February 1967	96	SECRET
Deseret Test Center, Semi-Annual Status Report, Current Activities to 15 July 1966	140	SECRET
Deseret Test Center, Semi-Annual Status Report, Current Activities to 15 July 1968	45	SECRET
Developmental Test of Hyfed Phosphorous Detector Data Report, January 1973	38	UNCLAS

Dissemination and Evaluation of a Tracer Material Release (NIGHT TRAIN) Volume II Data Supplement 30 June 1964	298	UNCLAS
Dissemination and Evaluation of a Tracer Material Release COPPER HEAD April 1966	68	CONF
DPG Test 73-30 Effect of Ambient Solar Radiation on Captive Aerosols (Microfilament Technique) and Free-Floating Aerosols Final Report, October 1973	136	UNCLAS
DPG Test 74-010 Phase 1 Operational Evaluation of Massive Chemical Attack Final Report	130	SECRET
DPG Test 74-010 Phase I Operational Evaluation of Massive Chemical Attack (U)	84	SECRET
DPG Test 74-010 Phase II Vulnerability of Marine Wing Weapons Unit (U)	78	SECRET
DPG Test 74-010 Phase II Vulnerability of Marine Wing Weapons Unit (U)	123	SECRET
DPG-Test 70-74 Phase 3, Comparison of biological Aerosol Decay Microfilament Technique versus free-floating Aerosols Test Plan by John H. Morris, Aug 73	15	UNCLAS
DTC Outline Plans for FY 73, March 1971	80	SECRET
DTC Program for FY 72, March 1971	73	SECRET
DTC Special Study R-12 (U) Preliminary Investigation of Chemical Agent Challenges to US Navy Ships at Sea	103	SECRET
DTC Study 71-152M Phase II: Canopy Penetration of Aerially Disseminated Chemical Materials, Final Report, January 1973	74	UNCLAS
DTC Test 65-11 Final Report March 1968	108	CONF
DTC Test 66-1 DEVIL HOLE Phase II Final Report May 1968	183	CONF
DTC Test 66-13 Final Report March 1968	253	SECRET
DTC Test 66-2 (Phase I) Final Report June 1968	81	CONF
DTC Test 66-3 SWAMP OAK Final Report March 1968	132	CONF
DTC Test 66-4 GREEN MIST Final Report Volume I June 1969	37	CONF
DTC Test 66-4 GREEN MIST Final Report Volume II August 1970	165	CONF
DTC Test 66-8 Phase II Final Report May 1968	227	CONF
DTC Test 67-2 Final Report July 1968	137	CONF

DTC Test 67-7 Final Report May 1968	182	SECRET
DTC Test 67-8 Final Report December 1968	185	SECRET
DTC Test 68-10 Test Plan February 1968	31	CONF
DTC Test 68-12 Test Plan February 1968	25	CONF
DTC Test 68-13, Phases I, II, III and DTC Test 69-12 Final Report Volume I February 1972	73	SECRET
DTC Test 68-13, Phases I, II, III and DTC Test 69-12 Final Report Volume II. Extent and Duration of Downwind Hazard for Chemical Agents GA and GD August 1972	53	SECRET
DTC Test 68-50 Final Report Volume I March 1969	36	SECRET
DTC Test 68-50 Final Report Volume II April 1969	194	SECRET
DTC Test 68-52 CLIFF ROSE Test Plan 7 October 1968	50	CONF
DTC Test 68-53 Phase I Final Report Volume II February 1971	241	UNCLAS
DTC Test 68-53 Phase I Final Volume I Report March 1971	152	UNCLAS
DTC Test 68-71 Final Report	115	SECRET
DTC Test 69-10 Final Report Volume I Coordination Draft October 1969	37	SECRET
DTC Test 69-10 Final Report Volume II April 1971	192	CONF
DTC Test 69-10 Test Plan April 1969	46	CONF
DTC Test 69-12 Phase I Test Plan May 1968	4	CONF
DTC Test 69-13 Test Plan April 1968	12	SECRET
DTC Test 69-14, Simulant Phase I, Test of MC-1 Bomb, Final Report, Volume I October 1972	67	UNCLAS
DTC Test 69-31 Final Report Volume I 29 May 1969	23	SECRET
DTC Test 69-31 Final Report Volume II 29 May 1969	69	CONF
DTC Test 69-31 Test Plan March 1968	33	SECRET
DTC Test 69-32 Final Report Volume I May 1970	38	SECRET
DTC Test 69-32 Final Report Volume II September 1970	167	SECRET
DTC Test 69-71 Test Plan, April 1968	33	CONF
DTC Test 69-71 Test Plan, April 1968	33	CONF
DTC Test 69-75 Final Report Volume I June 1969	39	SECRET
DTC Test 69-75 Final Report Volume II June 1969	198	SECRET
DTC Test 70-10 Phase I Test Plan, June 1971	30	UNCLAS

DTC Test 70-11, Phase I Evaluation of Delivery and Assessment Techniques for Simulant Aircraft Spray Systems Revised Test Plan, June 1972	40	UNCLAS
DTC Test 70-73 Secondary Aerosol Study Final Report Volume I April 1972	23	UNCLAS
DTC Test 70-73 Test Plan July 1969	17	SECRET
DTC Test 70-74 - Phase II Viability Decay Study of Microfilament Impacted Organisms in a Controlled Environmental Mobile Facility Final Report, June 1973	92	UNCLAS
DTC Test 70-C (Phase I) Test Plan, March 1970	20	UNCLAS
DTC Test 70-C Characterization of the Naturally Occurring Particulates in the Marine Atmosphere Test Plan, May 1972	17	UNCLAS
DTC Test 70-C Characterization of the Naturally Occurring Particulates in the Marine Atmosphere Trial One Data Summary, January 1973	31	UNCLAS
DTC Test 70-C Trial Two Characterization of the Naturally Occurring Particulates in the Marine Atmosphere Data Report, June 1973	97	UNCLAS
DTC Test Plan 69-36	28	CONF
DTCTP 64-6 (Revised) YELLOW LEAF Test Plan November 1964	64	CONF
EAGER BELLE Phase 2 Final Report March 1964	74	CONF
ELK HUNT Phase I Test 65-14 Test Plan 1964	56	UNCLAS
Employment of YAG 39 and YAG 40 in Support of Toxic Chemical Field Testing	52	UNCLAS
FY 86 through FY 91 Test/Study Programs for Joint Chemical/Biological Contact Point and test	98	SECRET
FY86 through FY91Test/Study Programs for Joint Chemical/Biological (CB) contact Point and Test, July 1985	180	SECRET
George Eastman, Dictionary of American Naval Fighting Ships	2	UNCLAS
High Altitude Release Special Study in Support of DTC Test 70-D, August 1972	52	UNCLAS
History of the USS George Eastman (YAG-39)	3	UNCLAS
History of the USS Tioga County (LST-1158) December 26, 1998	3	UNCLAS
History of USS Granville Hall (YAG-40) During Operation Redwing (1956)	2	UNCLAS

Independent Review of the Possible Health Hazards of the Large-Scale Release of Bacteria During the Dorset Defence Trials	39	UNCLAS
Information Security Guidance for NIGHT TRAIN DTCTP 54-5 31 October 1963	31	CONF
Installation Assessment of Gerstle River Test Site Records Evaluation Report No. 105 Volume 1, December 1976	58	UNCLAS
Investigative Report by Alaska Community Action on Toxics for Delta Junction, Alaska, The Nuclear Reactor at Fort Greely, May 2000	53	UNCLAS
Joint Chemical/Biological (CB) Contact Point and Test Project D049 Program Plan, June 1988	145	CONF
Joint Meeting of the Agents Committee and the Engineering & Production Committee, Chemical Corps Advisory Council, 8-9 March 1962 at Army Chemical Center and Fort Detrick, Maryland, November 1962	87	SECRET
Logistical Support Plan Test Series 65-11 SUN DOWN Test Series 66-3 SWAMP OAK 20 August 1965	6	UNCLAS
Logistical Support Plan Test Series 66-1 DEVIL HOLE II 31 May 1966	9	UNCLAS
Logistical Support Plan Test Series 66-10 PIN POINT 14 April 1966	7	UNCLAS
Logistical Support Plan Test Series 66-13 HALF NOTE 21 June 1966	10	UNCLAS
Logistical Support Plan Test Series 66-5 PURPLE SAGE 9 August 1965	7	UNCLAS
Logistical Support Plan Test Series 66-8 WEST SIDE II 25 August 1965	7	UNCLAS
Logistical Support Plan Test Series 67-7 RED CLOUD 29 August 1966	11	UNCLAS
MAGIC SWORD Test 65-4 Test Plan December 1964	17	CONF
Meeting of the Dissemination & Field Testing Committee, Edgewood Arsenal CBR Advisory Council, 10-11 October 1963 at Edgewood Arsenal and Fort Detrick, Maryland, May 1964	105	SECRET

Meeting of the Dissemination & Field Testing Committee, Edgewood Arsenal CBR Advisory Council, 3-4 December 1964 at Edgewood Arsenal and Fort Detrick, Maryland, Volume II, April 1965	25	CONF
Memorandum, Command History (USS Granville S. Hall), 23 April 1968	1	UNCLAS
Memorandum, Command History Report Symbol OPNAV 5757-4; submission of. (USS Navarro), 6 January 1964	3	UNCLAS
Memorandum, History of Commissioned Ship USS George Eastman, 2 March 1965	2	UNCLAS
Memorandum, History of Commissioned Ship USS George Eastman; continuation of. 25 April 1967	4	UNCLAS
Memorandum, History of USS Granville S. Hall (YAG40); submission of, 28 January 1967	3	UNCLAS
Memorandum, Ship's History, 1965 (USS George Eastman), 4 January 1966	4	UNCLAS
Memorandum, Ship's History; forwarding of (USS Hoel) 22 January 1964	3	UNCLAS
Memorandum, USS Navarro (APA215) History, Forwarding of. 19 September 1945	9	UNCLAS
Memorandum, USS Navarro (APA-215); history of 1964. 24 May 1965	4	UNCLAS
Methodology Study for Arriving at Agent Decay Parameters as Cloud travels Downwind	47	CONF
Monthly Personnel Roster, Co A, 1st Bn, 8th Marines, 2d MARDIV, April 1969	89	UNCLAS
Monthly Personnel Roster, Co B, 1st Bn, 8th Marines, 2d MARDIV, April 1969	58	UNCLAS
Monthly Personnel Roster, Co C, 1st Bn, 8th Marines, 2d MARDIV, April 1969	21	UNCLAS
Monthly Personnel Roster, Co C, 1st Bn, 8th Marines, 2d MARDIV, August 1969	58	UNCLAS
Monthly Personnel Roster, Co C, 1st Bn, 8th Marines, 2d MARDIV, June 1969	45	UNCLAS
Monthly Personnel Roster, Co C, 1st Bn, 8th Marines, 2d MARDIV, March 1969	15	UNCLAS
Monthly Personnel Roster, Co C, 1st Bn, 8th Marines, 2d MARDIV, May 1969	32	UNCLAS
Monthly Personnel Roster, Headquarters & Service Co, 1st Bn, 8th Marines, 2d MARDIV, April 1969	69	UNCLAS

Monthly Personnel Roster, Headquarters & Service Co, 1st Bn, 8th Marines, 2d MARDIV, June 1969	11	UNCLAS
Monthly Personnel Roster, Headquarters & Service Co, 1st Bn, 8th Marines, 2d MARDIV, May 1969	73	UNCLAS
NAVSEA Shipboard Chemical and Biological Defense Bibliography and Assessment March 1997	76	UNCLAS
Navy BW/CW Information Requirements and Recommendations on Test Objectives Including Extraterritorial Test Requirements for FY 68/69, 11 March 1966	111	SECRET
NIGHT TRAIN Test 64-5 Final Report December 1964	175	CONF
NRL Memorandum Report 1520, Studies of Personnel Protection Systems Aboard YAG-39, March 1964	16	CONF
Operation Castle, Bikini Atoll, May 1954, History of USS Tawakoni ATF114 During Operation Castle 1954	2	UNCLAS
Operation Salty Dog, Army Dugway Proving Ground, Ut, 9Sep 53	9	UNCLAS
Operation Transit III, Description of Facilities, YAG 40 Control Vessel, December 5, 1955	25	UNCLAS
Preliminary Critiques of proposed DTC FY 70 biological Test Plans	38	CONF
Preliminary Critiques of Proposed DTIC FY 71 Biological Test Plans	38	CONF
Preliminary Field Study Comparison of Fluidizers and Fluorescent Materials in Support of DTC Test 70-D Final Report, May 1972	66	UNCLAS
Pre-Test Technology for DTC Joint Test 70-C Test Plan, May 1971	13	UNCLAS
Project "SHAD" Technical Staff Training Program, 24 August 1962	97	UNCLAS
Project BIG TOM Analysis of Weapon Effectiveness March 1966	284	CONF
Project BIG TOM UL and OU Casualty Estimates	35	CONF
Project Deseret. Annual Historical Summary, 1 July 1962 - 30 June 1963	155	CONF
Project Deseret. Annual Historical Summary, 1 July 1963 - 30 June 1964	22	CONF

Project Deseret. Annual Historical Summary, 1 July 1964 - 30 June 1965	30	CONF
Project Deseret. Annual Historical Summary, 1 July 1965 - 30 June 1966	38	CONF
Project Deseret. Annual Historical Summary, 1 July 1967 - 30 June 1968	30	SECRET
Project Deseret. Annual Historical Summary, 1 July 1968 - 30 June 1969	30	SECRET
Project Deseret. Annual Historical Summary, 1 July 1969 - 30 June 1970	62	CONF
Project NIGHT TRAIN Supplemental Analysis September 1965	153	CONF
Project SHAD DPG Detailed Test Plan for Operation Southern Breeze	123	UNCLAS
Project SHAD Technical Staff Enlisted and Officer Personnel Roster, 16 January 1965	14	UNCLAS
Project Shad: DPG Test 70-74 Phase, Comparison of Biological Aerosol Decay Microfilament Technique free-floating Aerosols Test Plan, Aug 73	19	UNCLAS
Project Shad: Final Report Penetration of Aerial Spray through a Coniferous Forest December 1978	55	UNCLAS
Project Shad: Monthly Progress Report, No 240 (R)-14, 31 Aug 66	25	UNCLAS
Project Shad: Quarterly Report, No 448-3 April-June 1960	51	UNCLAS
Project Shad: Shoreline Diffusion Program Oceanside, CA Vol III Data, June 1969	216	UNCLAS
Project Shad: Trial Report, Operation Salty Dog DPGTR 91	33	UNCLAS
Project Shad: U.S.S. Carbonero (SS337) Deck Log Book (Dated 0001 1 Aug 66 Through 2400 31 Aug 66)	11	UNCLAS
Project Shad: U.S.S. Carbonero (SS337) Deck Log Book (Dated 0001W, 1 Sep 68-2400I, 30 Sep 68) Part II	2	UNCLAS
Project Shad: U.S.S. Carbonero (SS337) Deck Log Book (Dated 010000 1 Sep 66 through 302400 30 Sep 66)	34	UNCLAS
Project Shad: Comparison of Calculated and Observed Dosage and Deposition for Subtest Series	55	UNCLAS

Project SHAD: Deseret Test Center: Technical Note, Candidate Bacterial Species for Research in Biological Defense, August 1971	44	UNCLAS
Project SHAD: DPG Addendum to Detailed Test Plan for Operation Southern Breeze	56	UNCLAS
Project Shad: DPG Test 70-11 Phase I Subtest 4, Evaluation of Delivery and Assessment Techniques for Aircraft Spray (Simulant) Systems, October 1976	59	UNCLAS
Project Shad: Safety Evaluation of TMU-28/B Spray Tank Final Report June 1978	190	UNCLAS
Project Shad: Technical report Assessment of Operational Capability of US Forces After Biological Agent Attack, Sept 1990	47	UNCLAS
Project Shad: Trial Report Operation Salty Dog DPGtr44	9	UNCLAS
Project Shad: trial Report, Operational Salty Dog DPGTR 58	5	UNCLAS
Project Shad: U.S.S. Carbonero Deck Log Book (SS337) Dated 0001, 1 Nov 68-2400l, 30 Nov 68	2	UNCLAS
Project Shad: U.S.S. Carbonero Deck Log Book (SS337) Dated 0001W, 1 Sep 68 through 2400i, 30 SEP 68 Part 1	2	UNCLAS
Project Shad: U.S.S. Carbonero Deck Log Book (SS337) Dated 010001 Oct 68 to 312400 Oct 68	2	UNCLAS
Proposed DTC FY-70 Test Plans, September 1968	181	SECRET
Quarterly Progress Report Phase III, B/DWS, Model DA-88, 31 July 1963	85	CONF
Quarterly Progress Report Phase III, B/DWS, Model DA-88, Covering Period May 1963 through July 1963, 31 July 1963	83	CONF
RED BEVA 1964	20	CONF
RED OAK I Data Analysis October 1967	91	CONF
Reference Decontamination and Removal of Staphylococcal Enterotoxin B From Swatches of Cotton Clothing Deseret Test Center Fort Douglas, UT, Aug 1968	7	UNCLAS
Report No. 402-1-R26, 65-L-40 Data Analysis FLOWER DRUM Phase 1B Final Report June 1965	236	CONF
Report No. 402-2-R4(7) Data Analysis - FEARLESS JOHNNY Final Report July 1967	109	CONF

Report No. SM-42842 B/DWS Progress Report No. 27 Model DA-88 May 1, 1963	6	UNCLAS
Report of Proof Tests, LT Tug 2081 (Crew Training, Challenge and Decon of Target Ship)	113	CONF
Report of the Annual DTC CINCS/Services CB Coordination Conference (9th) held at Dugway Proving Ground, Utah, on 22-24 June 1971	104	CONF
Report of the Annual DTC CINCS/Services CB Coordination Conference 10th, held at Fort Douglas, Utah on April 1972	80	SECRET
Report of the Deseret Test Center Medical Advisory Committee, 21 March 1964	23	CONF
Report Operations Research Incorporated, Information Retrieval System for Deseret Test Center 30 April, 1966	35	UNCLAS
Results of Contamination Studies, 70-11 Phase I August 1974	1	UNCLAS
Second Preliminary Report - Phase II (Use Analysis) Volume II, 1 Oct 64 - 16 Nov 64	43	CONF
Second Preliminary Report-Phase II (Use Analysis) Volume II, 1 Oct 1964 to 16 Nov 1964	42	CONF
Secret Report Bibliography	16	SECRET
Semiannual Status Report, February 1972	12	SECRET
Semiannual Status Report, January 1973	15	SECRET
Semiannual Status Report, July 1972	17	SECRET
SHAD-related Documents at Porton Down 14 February 2002	37	UNCLAS
Special Study Number 5, Penetration of Enclosures by Chemical and Biological Aerosol, Vapor, and Particulate Clouds, Final Report, October 1969	90	SECRET
"Strictly for the Birds": Science, the Military and the Smithsonian's Pacific Biological Survey Program, 1963-1970, extracted from the Journal of the History of Biology 34: 315-352, 2001.	37	UNCLAS
Studies of Personnel Protection Systems Aboard YAG-39, March 1964	18	CONF
Summary of Discussions and Agreements reached at the Fourth Annual Deseret Test Center Planning Conference, 21 October 1965	7	CONF
Summary Report of Fifth Annual Deseret Test Center Planning Conference, 23 September 1966	21	SECRET

Summary Report of the Proceedings of the Eighth Annual Deseret Test Center Planning Conference, 3 July 1969	34	SECRET
SUN DOWN 1967	11	CONF
TALL TIMBER Test 64-8 Test Plan December 1963	110	CONF
Task RED BEVA Part I, Source Strength Requirements for Biological Agent Dissemination Tests, 30 April 1963	35	SECRET
Task RED BEVA Part II, Meteorological Data Requirements for Biological Agent Dissemination Tests, 30 April 1963	32	SECRET
Task RED BEVA Part III, Decay Data Requirements for Biological Agent Dissemination Tests, 31 July 1963	25	SECRET
Technical Note #8 Comments on Coordination Draft Test Plan of Test 66-6 SCARLET SAGE June 1965	14	UNCLAS
Technical Report Amphibious Operations in a Toxic Chemical Environment Phase I	86	SECRET
Technical Report Assessment of Operational Capability of US Forces After Biological Agent Attack September 1990	47	UNCLAS
Technical Report DTC Study 71-111, Phase III Amphibious Operations in a toxic Environment Penetrating Round effects	88	SECRET
Technical Report Sorption of G and V Agent Study	62	CONF
Technical Report Sorption of G and V Agent Study	134	CONF
Test 64-2 FLOWER DRUM Phase I Final Report - Revised December 1965	75	CONF
Test 64-2 FLOWER DRUM Phase II Final Report - October 1965	122	CONF
Test 64-4 Shady Grove Final Report	280	SECRET
Test 64-4 SHADY GROVE Final Report December 1965	362	SECRET
Test 64-4 SHADY GROVE Final Report June 1966	322	SECRET
Test 64-6 YELLOW LEAF Final Report October 1967	186	SECRET
Test 64-8 TALL TIMBER and Trial Groups A and B of Test 65-16 PINE RIDGE Final Report October 1967	143	CONF
Test 64-8 TALL TIMBER Test Plan - Revised December 1965	17	SECRET

Test 65-1 COPPER HEAD Final Report March 1966	95	CONF
Test 65-1 COPPER HEAD Test Plan December 1964	33	CONF
Test 65-12 DEVIL HOLE December 1966	165	CONF
Test 65-12 DEVIL HOLE Phase 1 Test Plan January 1965	29	SECRET
Test 65-13 HIGH LOW Final Report July 1966	200	CONF
Test 65-14 ELK HUNT Phase I Final Report November 1965	173	CONF
Test 65-14 ELK HUNT Phase I Final Report Supplement December 1965	104	UNCLAS
Test 65-14 ELK HUNT Phase II Final Report September 1966	134	CONF
Test 65-16 PINE RIDGE Final Report November 1967	97	CONF
Test 65-17 FEARLESS JOHNNY Final Report November 1966	117	CONF
Test 65-17 FEARLESS JOHNNY Test Plan Addendum August 1965	25	CONF
Test 65-3 WEST SIDE Phase I Final Report June 1966	220	CONF
Test 65-4 MAGIC SWORD Final Report May 1966	113	CONF
Test 65-5 IRON CLAD Test Plan January 1965	25	SECRET
Test 65-6 BIG TOM Final Report January 1967	253	SECRET
Test 65-6 BIG TOM Test Plan Addendum March 1964	9	SECRET
Test 65-6 BIG TOM Test Plan December 1964	92	SECRET
Test 66-1 DEVIL HOLE Phase II Test Plan February 1966	32	CONF
Test 66-10 PIN POINT Final Report December 1966	127	UNCLAS
Test 66-13 HALF NOTE Test Plan Addendum July 1966	6	SECRET
Test 66-13 HALF NOTE Test Plan Amendment September 1966	5	CONF
Test 66-13 HALF NOTE Test Plan June 1966	18	CONF
Test 66-2 RED OAK Phase I Test Plan August 1966	13	CONF
Test 66-3 SWAMP OAK Test Plan July 1965	14	CONF
Test 66-4 GREEN MIST Test Plan Addendum October 1966	5	CONF

Test 66-4 GREEN MIST Test Plan December 1965	27	CONF
Test 66-5 PURPLE SAGE Final Report January 1967	89	CONF
Test 66-6 SCARLET SAGE Final Report April 1967	110	SECRET
Test 66-8 WEST SIDE Phase II Test Plan August 1965	14	CONF
Test 67-12 SHARP NAIL Test Plan September 1966	11	SECRET
Test 67-2 DEW POINT Test Plan January 1967	9	CONF
Test 67-7 COINCIDENCE Test Plan July 1966	9	SECRET
Test 67-8 WATCH DOG Test Plan Addendum April 1967	6	SECRET
Test 67-8 WATCH DOG Test Plan February 1967	12	SECRET
Test 68-15 RED OAK Phase II Test Plan January 1967	47	CONF
Entomological Warfare Target Analysis	58	SECRET
US Army Activity in the US Biological Warfare Programs Volume I, 24 February 1977	39	UNCLAS
US Army Activity in the US Biological Warfare Programs Volume II, 25 February 1977	599	SECRET
US BW Agent Testing Using Human Subjects	22	UNCLAS
USS Berkeley (DDG-15) Muster Rolls, Enlisted, 1966	196	UNCLAS
USS Berkeley (DDG-15) Muster Rolls, Enlisted, 1965	237	UNCLAS
USS Berkeley (DDG-15) Muster Rolls, Officers, 1965	31	UNCLAS
USS Berkeley (DDG-15) Muster Rolls, Officers, 1966	36	UNCLAS
USS Carpenter (DD-825) Muster Rolls, Officer and Enlisted, 1963	61	UNCLAS
USS Carpenter (DD-825) The Ship and Her History	5	UNCLAS
USS Fechteler (DD-870) Muster Rolls, Enlisted, 1965	187	UNCLAS
USS Fechteler (DD-870) Muster Rolls, Enlisted, 1966	214	UNCLAS
USS Fechteler (DD-870) Muster Rolls, Officer, 1965	28	UNCLAS
USS Fechteler (DD-870) Muster Rolls, Officer, 1966	26	UNCLAS
USS Fort Snelling (LSD-30) Muster Rolls, Enlisted, 1969	184	UNCLAS

USS Fort Snelling (LSD-30) Muster Rolls, Officer, 1969	30	UNCLAS
USS George Eastman (YAG-39) Muster Rolls, Officer and Enlisted, 1963	120	UNCLAS
USS George Eastman (YAG-39) Muster Rolls, Officer and Enlisted, 1964	101	UNCLAS
USS George Eastman (YAG-39) Muster Rolls, Officer and Enlisted, 1965	103	UNCLAS
USS George Eastman (YAG-39) Muster Rolls, Officer and Enlisted, 1966	93	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Enlisted, 1967	61	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer and Enlisted, 1963	115	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer and Enlisted, 1964	104	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer and Enlisted, 1965	104	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer and Enlisted, 1966	94	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer and Enlisted, 1968	104	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer and Enlisted, 1969	33	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer and Enlisted, 1970	32	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer, 1967	17	UNCLAS
USS Herbert J. Thomas (DD-833) Muster Rolls, Enlisted, July-August-September 1968	49	UNCLAS
USS Herbert J. Thomas (DD-833) Muster Rolls, Enlisted, May-June 1966	42	UNCLAS
USS Herbert J. Thomas (DD-833) Muster Rolls, Officer and Enlisted, January-February-March 1966	70	UNCLAS
USS Herbert J. Thomas (DD-833) Muster Rolls, Officer, 1968	16	UNCLAS
USS Herbert J. Thomas (DD-833)	2	UNCLAS
USS Hoel (DDG-13) Muster Rolls, Enlisted, 1963	65	UNCLAS
USS Hoel (DDG-13) Muster Rolls, Officer, 1963	15	UNCLAS
USS Hoel DDG-13 History	6	UNCLAS

USS Navarro (APA-215) Muster Rolls, Enlisted, 1963	68	UNCLAS
USS Navarro (APA-215) Muster Rolls, Officer, 1963	21	UNCLAS
USS Navarro (APA-215), Dictionary of American Naval Fighting Ships	2	UNCLAS
USS Okanogan (APA-220) Muster Rolls, Enlisted, 1965	142	UNCLAS
USS Okanogan (APA-220) Muster Rolls, Enlisted, 1966	37	UNCLAS
USS Okanogan (APA-220) Muster Rolls, Officer, 1965	31	UNCLAS
USS Okanogan (APA-220) Muster Rolls, Officer, 1966	8	UNCLAS
USS Power (DD-839) 1965	3	UNCLAS
USS Power (DD-839) History	2	UNCLAS
USS Power (DD-839) Muster Rolls, Officer and Enlisted, 1965	54	UNCLAS
USS Tioga County (LST-1158) Muster Rolls, Officer and Enlisted, January-June 1963	43	UNCLAS
USS Wexford County (LST-1168) Muster Rolls, Enlisted, 1965	97	UNCLAS
USS Wexford County (LST-1168) Muster Rolls, Enlisted, 1966	106	UNCLAS
USS Wexford County (LST-1168) Muster Rolls, Officer, 1965	19	UNCLAS
USS Wexford County (LST-1168) Muster Rolls, Officer, 1966	20	UNCLAS
WEST SIDE Test 65-3 Test Plan August 1964	16	CONF
WHISTLE DOWN Final Report November 1963	322	CONF
YELLOW LEAF Test Analysis January 1967	173	CONF
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Each Test under Project 112 Identified

Records and Information Passed to the VA

The following chart shows all tests planned by the Deseret Test Center between FY63 and FY74 and whether it was conducted, cancelled or deferred. The Deseret Test Center planned 134 tests and completed 50. Eighty-four were cancelled or deferred. Those tests that were deferred or cancelled are marked accordingly on the chart.

In addition to summarizing dates, locations and substances used, the chart also indicates, for completed tests, when the fact sheet (FS) was released and whether a personnel roster (PR) has been completed and passed to the VA.

The three-ring binder accompanying this report contains a copy of the most current fact sheet for each test. The fact sheets contain the test number and name when one was found, the dates of the test, location when known, vessels and/or military units involved, test purpose or objective and the substances used. In several cases, tests were conducted in phases; fact sheets were prepared for each phase actually completed for a total of 56 published fact sheets for the 50 conducted tests.

Project 112 Tests

Deseret Test Center Project 112 was a Cold war-era chemical and biological warfare test program. This comprehensive program was initiated in 1962 out of concern for our nation's ability to protect and defend against these potential threats.

Updated July 23, 2003.

FS = Fact Sheet Released PR = Personnel Roster Provided * = New/Updated
Investigation Status Key: Investigating Test Status In Progress Complete

#	Test Name	Date	Location	Agent/ Simulant	Investigation Status	Information at VA
FY 63						
1	63-1 Eager Belle I [SHAD]	Jan - Mar 1963	Pacific Ocean	BG	Fact Sheet Released 1/31/2002	FS, PR
	Eager Belle II [SHAD]	Jan, Mar, Jun 1963	Pacific Ocean	BG	Fact Sheet Released 1/31/2002	FS, PR
2	63-2 Autumn Gold [SHAD]	May 1963	Pacific Ocean	BG	Fact Sheet Released 9/13/2001	FS, PR
3	63-3 Whistle Down	Dec 1962 - Feb 1963	Ft. Greely, AK	GB, VX	Fact Sheet Released 10/09/2002	FS
4	63-4 Big Jack A	Feb - Mar 1963	Ft. Sherman, Panama Canal Zone	BG, FP	Fact Sheet Released 10/31/2002	FS
	Big Jack B	Feb - Mar 1963	Ft. Sherman, Panama Canal Zone	TOF	Fact Sheet Released 10/31/2002	FS
FY 64						
5	64-1 Errand Boy [SHAD]	Sep 1963	Oahu, HI	BG	Fact Sheet Released 6/30/2003	FS, PR
6	64-2 Flower Drum I [SHAD]	Feb - Apr 1964 Aug - Sep 1964	Pacific Ocean	GB, SO2, MAA	Fact Sheet Released 5/23/2002	FS, PR
	Flower Drum II [SHAD]	Nov - Dec 1964	Pacific Ocean	VX, P32, Bis	Fact Sheet Released 5/23/2002	FS
7	64-3 Little Mo [SHAD]	NA	NA	NA	Test Cancelled	NA
8	64-4 [Red Beva] Shady Grove [SHAD]	Jan - Apr 1965	Pacific Ocean	BG, OU, UL	Fact Sheet Released 9/13/2001	FS, PR
9	64-5 Night Train	Nov	Ft. Greely, AK	BG, FP	Fact Sheet Released	FS

		1963 - Jan 1964			10/09/2002	
10	64-6 Yellow Leaf	Feb 1964, Apr - May 1966	Ft. Sherman, Panama Canal Zone, Island of Hawaii	BG, Tiara	Fact Sheet Released 10/31/2002	FS, PR
11	64-7 Big Thunder	NA	NA	NA	Test Cancelled	NA
12	64-8 Tall Timber	Apr - Jun 1966	Island of Hawaii	BZ	Fact Sheet Released 10/09/2002	FS, PR
13	64-9 Big Piney	NA	NA	NA	Test Cancelled	NA
14	64-10 [65-18] Black Label	NA	NA	NA	Test Deferred/Renumbered	NA
15	64-11 [65-19] Laurel Grove	NA	NA	NA	Test Deferred/Renumbered	NA
FY 65						
16	65-1 Copper Head [SHAD]	Jan - Feb 1965	Atlantic Ocean off Newfoundland, Canada	BG, FP, Beta-propiolactone	Fact Sheet Released 9/13/2001	FS, PR
17	65-2 Chain Saw	NA	NA	NA	Test Cancelled	NA
18	65-3 West Side I	Jan - Feb 1965	Ft. Greely, AK	BG, FP	Fact Sheet Released 10/09/2002	FS, PR
19	65-4 Magic Sword [SHAD]	May 1965	Baker Island	mosquitoes (Aedes aegypti)	Fact Sheet Released 10/09/2002	FS, PR
20	65-5 Iron Clad [SHAD]	NA	NA	NA	Test Cancelled	NA
21	65-6 Big Tom [SHAD]	May - Jun 1965	Pacific Ocean, off Oahu, HI & surrounding water & airspace	BG, FP	Updated Fact Sheet Released 6/30/2003	FS, PR
22	65-7 Great Sole [SHAD]	NA	NA	NA	Test Cancelled	NA
23	65-8 Lone Wolf [SHAD]	NA	NA	NA	Test Cancelled	NA
24	65-9 Silver Star	NA	NA	NA	Test Cancelled	NA
25	65-10 Little Egypt	NA	NA	NA	Test Cancelled	NA
26	65-11 [Bear River] Sun Down	Feb, Apr 1966	Ft. Greely, AK	GB, MAA, Tiara	Fact Sheet Released 10/09/2002	FS
27	65-12 Devil Hole I	Summer 1965	Ft. Greely, AK	GB, FP	Fac Sheet Released 10/09/2002	FS
28	65-13 High Low [SHAD]	Jan - Feb 1965	Pacific Ocean off San Diego, CA	MAA	Corrected Fact Sheet Released 12/31/2002	FS, PR
29	65-14 Elk Hunt I	Jul - Aug	Ft. Greely, AK	VX	Fact Sheet Released 10/09/2002	FS, PR

		1964				
	Elk Hunt II	Jun - Jul 1965 Oct - Dec 1965	Ft. Greely, AK & Edgewood Arsenal, MD, & Canada	VX	Fact Sheet Released 10/09/2002	FS, PR
30	65-15 Little Corporal	NA	NA	NA	Test Cancelled	NA
31	65-16 Pine Ridge	May - Jun 1966	Island of Hawaii	GB, BZ	Fact Sheet Released 10/09/2002	FS, PR
32	65-17 Fearless Johnny [SHAD]	Aug - Sep 1965	Pacific Ocean southwest of Oahu, HI	VX, Diethylphthlate	Fact Sheet Released 5/23/2002	FS, PR
33	65-18 [64-10] Black Label	NA	NA	NA	Test Cancelled	NA
34	65-19 [64-11] Laurel Grove	NA	NA	NA	Test Cancelled	NA
FY 66						
35	66-1 Devil Hole II	Jul - Aug 1966	Ft. Greely, AK	VX	Fact Sheet Released 10/09/2002	FS, PR
36	66-2 Red Oak I	Apr - May 1967	Island of Hawaii, Ft. Sherman, Panama Canal Zone	GB	Fact Sheet Released 10/31/2002	FS, PR
37	66-3 Swamp Oak I	Mar - Apr 1966	Ft. Greely, AK	GB	Fact Sheet Released 10/09/2002	FS
38	66-4 Green Mist	Mar - Apr 1967	Island of Hawaii	GB, MAA	Fact Sheet Released 10/09/2002	FS, PR
39	66-5 Purple Sage [SHAD]	Jan - Feb 1966	Pacific Ocean off San Diego, CA	MAA	Fact Sheet Released 5/23/2002	FS, PR
40	66-6 Scarlet Sage [SHAD]	Feb - Mar 1966	Pacific Ocean off San Diego, CA	BG	Fact Sheet Released 1/31/2002	FS, PR
41	66-7 Clay Pigeon I	NA	NA	NA	Test Cancelled	NA
42	66-8 West Side II	Jan - Mar 1965	Southwestern Canada	BG, FP	Fact Sheet Released 10/09/2002	FS
43	66-9 Magic Sword II [SHAD]	NA	NA	NA	Test Cancelled	NA
44	66-10 Pin Point	1966	Unspecified	CS	Fact Sheet Released 10/31/2002	FS
45	66-11 Ebony Sun [SHAD]	NA	NA	NA	Test Cancelled	NA
46	66-12 [Bald	NA	NA	NA	Test Cancelled	NA

	Eagle I] Bold Captain [SHAD]					
47	66-13 Half Note [SHAD]	Aug - Sep 1966	Pacific Ocean, off Hawaii	BG, E.coli, FP SM, calcaflour	Updated Fact Sheet Released 6/30/2003	FS, PR
48	66-14 Sandy Point [SHAD]	NA	NA	NA	Test Cancelled	NA
FY 67						
49	67-1 [68-15] Red Oak II	NA	NA	NA	Test Deferred/Renumbered	NA
50	67-2 Dew Point	Jun - Jul 1967	Ft. Greely, AK	GB	Fact Sheet Released 10/09/2002	FS
51	67-3 [68-11] [69-13] Tiny Doll	NA	NA	NA	Test Deferred/Renumbered	NA
52	67-4 Blue Note [SHAD]	NA	NA	NA	Test Cancelled	NA
53	67-5 Work Horse [SHAD]	NA	NA	NA	Test Cancelled	NA
54	67-6 Blue Tango	Jan - Feb 1967	Hawaii	BG, E.coli, SM	Fact Sheet Released 6/30/2003	FS, PR
55	67-7 [Coincidence] Red Cloud	Nov 1966 - Feb 1967	Ft. Greely, AK	BG, E.coli, SM, TT, ZZ	Fact Sheet Released 10/09/2002	FS
56	67-8 [Autobiography] Watch Dog	Summer 1967	Ft. Greely, AK	BG, E.coli, SM, TT, ZZ	Fact Sheet Released 10/09/2002	FS
57	67-9 [Key Fruit] Gray Fox [SHAD]	NA	NA	NA	Test Cancelled	NA
58	67-10 [Meddled] Night Fire [SHAD]	NA	NA	NA	Test Cancelled	NA
59	67-11 [Expunge] Slow Waltz [SHAD]	NA	NA	NA	Test Cancelled	NA
60	67-12 [68-72] [69-70] [Expulsion] Sharp Nail [SHAD]	NA	NA	NA	Test Deferred/Renumbered	NA
61	67-13 Steel Point	NA	NA	NA	Test Cancelled	NA
FY 68						
62	68-10 [68-2] Sharp Ravine	NA	NA	NA	Test Cancelled	NA
63	68-11 [67-3] [69-13] Tiny Doll	NA	NA	NA	Test Deferred/Renumbered	NA
64	68-12 [68-1]	NA	NA	NA	Test Cancelled	NA

	Narrow Trail					
65	68-13 [68-4] Rapid Tan	Jul - Aug 1967 May - Jun 1968 Aug - Sep 1968	Phase I & III - Porton Down, England, Phase II - Ralston, Canada	GA, GB, GD, VX	Fact Sheet Released 10/09/2002	FS
66	68-14 [68-3] Channel Crab	NA	NA	NA	Test Cancelled	NA
67	68-15 [67-1] Red Oak II	NA	NA	NA	Test Cancelled	NA
68	68-30 [68-5] [69-74] Prairie Carpet	NA	NA	NA	Test Deferred/Renumbered	NA
69	68-31 [68-6] [69-33] Exit Line [SHAD]	NA	NA	NA	Test Deferred/Renumbered	NA
70	68-33 [68-7] Wicked Slice	NA	NA	NA	Test Cancelled	NA
71	68-50 [68-11] Speckled Start [SHAD]	Sep - Oct 1968	Eniwetok Atoll, Marshall Islands	BG, PG2, uranine dye	Fact Sheet Released 5/23/2002	FS, PR
72	68-51 [68-9] Strange Fruit	NA	NA	NA	Test Cancelled	NA
73	68-52 Cliff Rose	Sep 27, 1967 - Jan 18, 1968	Ft Stewart Georgia and Panama Canal Zone	CS	Fact Sheet Released 12/9/2002	FS
74	68-53	Apr - Dec 1969	DPG, UT	CS	Fact Sheet Released 10/09/2002	FS
75	68-70 [68-12] Shining Pond	NA	NA	NA	Test Cancelled	NA
76	68-71 [68-13] Folded Arrow [SHAD]	Apr -May 1968	Oahu, HI and surrounding waters	BG	Fact Sheet Released 6/30/2003	FS, PR
77	68-72 [67-12] [69-70] Sharp Nail [SHAD]	NA	NA	NA	Test Deferred/Renumbered	NA
78	68-73 [68-8] [69-73] Leaning Shoe	NA	NA	NA	Test Deferred/Renumbered	NA
79	[68-10] Maple Board	NA	NA	NA	Test Cancelled	NA
FY 69						
80	69-10 [SHAD]	May 1969	Vieques, PR	TOF	Fact Sheet Released 10/09/2002	FS, PR
81	69-12	Spring 1969	Edgewood Arsenal, MD	GB, GD, GA, VX	Test Suspended Fact Sheet Released 10/09/2002	FS

82	69-13 [67-3] [68-11] Tiny Doll	NA	NA	NA	Test Cancelled	NA
83	69-14	Jul - Nov 1971	DPG, UT	DEHP	Fact Sheet Released 10/09/2002	FS
84	69-15 [SHAD]	NA	NA	NA	Test Cancelled	NA
85	69-16	NA	NA	NA	Test Cancelled	NA
86	69-30	NA	NA	NA	Test Cancelled	NA
87	69-31 [SHAD]	Aug - Sep 1968	Pacific Ocean off San Diego, CA	BG, MAA	Fact Sheet Released 10/09/2002	FS, PR
88	69-32 [SHAD]	Apr - Jun 1969	Pacific Ocean, southwest of Hawaii	BG, E.coli, SM, Calcaflour	Fact Sheet Released 5/23/2002	FS, PR
89	69-33 [68-6] [68-31] Exit Line [SHAD]	NA	NA	NA	Test Cancelled	NA
90	69-34	NA	NA	NA	Test Cancelled	NA
91	69-35	NA	NA	NA	Test Cancelled	NA
92	69-36 [SHAD]	NA	NA	NA	Test Cancelled	NA
93	69-37	NA	NA	NA	Test Cancelled	NA
94	69-70 [67-12] [68-72] Sharp Nail [SHAD]	NA	NA	NA	Test Cancelled	NA
95	69-71 [SHAD]	NA	NA	NA	Test Cancelled	NA
96	69-72 [SHAD]	NA	NA	NA	Test Cancelled	NA
97	69-73 [68-73] [68-8] Leaning Shoe	NA	NA	NA	Test Cancelled	NA
98	69-74 [68-5] [68-30] Prairie Carpet	NA	NA	NA	Test Cancelled	NA
99	69-75	Oct - Dec 1968	Yeehaw Junction, FL	TX	Fact Sheet Released 10/09/2002	FS
FY 70						
100	70-A	NA	NA	NA	Test Cancelled	NA
101	70-B	NA	NA	NA	Test Cancelled	NA
102	70-C [SHAD]	Oct 1972, Feb - Mar 1973	Pacific Ocean, from San Diego, CA to Babloa, Panama	NA	Fact Sheet Released 6/30/2003	FS
103	70-D	NA	NA	NA	Test Cancelled	NA
104	70-10	NA	NA	NA	Test Cancelled*	NA
105	70-11 Ph I, Subtest 3	Jun 1972 - Nov 1973	Dugway PG, UT	Bis, TOP, FP	Fact Sheet Released 6/30/2003	FS
	70-11 Ph I,	May	Dugway PG,	Bis	Fact Sheet Released	FS

	Subtest 4	1974	UT		6/30/2003	
106	70-12	NA	NA	NA	Test Cancelled	NA
107	70-30	NA	NA	NA	Test Cancelled*	NA
107	70-30	NA	NA	NA	Test Deferred	NA
108	70-31	NA	NA	NA	Test Cancelled	NA
109	70-50	NA	NA	NA	Test Cancelled	NA
110	70-70 [SHAD]	NA	NA	NA	Test Cancelled	NA
111	70-71 [SHAD]	NA	NA	NA	Test Cancelled	NA
112	70-72	NA	NA	NA	Test Cancelled	NA
113	70-73	Jul - Dec 1970	DPG, UT	BG, FP	Fact Sheet Released 10/09/2002	FS
114	70-74	Aug 1972 - Jan 1973	Dugway PG, UT	BG, SM	Fact Sheet Released 6/30/2003	FS
FY 71						
115	71-10	NA	NA	NA	Test Cancelled	NA
116	71-11	NA	NA	NA	Test Cancelled	NA
117	71-12	NA	NA	NA	Test Cancelled	NA
118	71-13	NA	NA	NA	Test Cancelled	NA
119	71-30	NA	NA	NA	Test Cancelled	NA
120	71-31	NA	NA	NA	Test Cancelled	NA
121	71-32	NA	NA	NA	Test Cancelled	NA
122	71-33	NA	NA	NA	Test Cancelled	NA
123	71-34	NA	NA	NA	Test Cancelled	NA
124	71-35	NA	NA	NA	Test Cancelled	NA
125	71-70	NA	NA	NA	Test Cancelled	NA
126	71-75	NA	NA	NA	Test Cancelled	NA
FY 72						
127	72-30 [SHAD]	NA	NA	NA	Test Cancelled*	NA
128	72-70 [SHAD]	NA	NA	NA	Test Cancelled*	NA
FY 73						
129	73-10	NA	NA	NA	Test Cancelled	NA
130	73-11	NA	NA	NA	Test Cancelled	NA
131	73-12	NA	NA	NA	Test Cancelled	NA
132	73-30	Jan - Feb 1973	Dugway PG, UT	BG, SM, P	Fact Sheet Released 6/30/2003	FS
FY 74						
133	74-10 Ph I	Sep - Oct 1973	Dugway PG, UT	DMMP, Bis, Trichloropropane	Fact Sheet Released 6/30/2003	FS
	74-10 Ph II	Apr - May 1974	Dugway PG, UT	DMMP	Fact Sheet Released 6/30/2003	FS

134	74-030	NA	NA	NA	Test Cancelled	NA

FS = Fact Sheet Released PR = Personnel Roster Provided * = New/Updated
Investigation Status Key: Investigating Test Status In Progress Complete

Service Members Present at the Tests

The following list contains the number of servicemembers who were present at each test. Many servicemembers were present during more than one test. The total number of military members identified as being present during one or more of these tests is 5,842.

SHAD SUMMARY REPORT

Autumn Gold	May 1963		
	APA-215	USS Navarro	393
	YAG-40	USS Granville S. Hall	112
	DD-825	USS Carpenter	268
	DDG-13	USS Hoel	399
	MARINE AIR GROUP 13	Marine AR Group 13	189
	LST-1158	USS Tioga County	175
		TOTAL	1,536
Big Tom	May - June 1965		
	YAG-40	USS Granville S. Hall	117
	SS 337	USS Carbonero	119
		TOTAL	236
Blue Tango	Jan - Feb 1967		
	DPG	N/A	30
		TOTAL	30
Copper Head	24 January - 25 February 1966		
	DD-839	USS Power	288
		TOTAL	288
Devil Hole II	Jul - Sep 1966		
	Land Base	Land Base	169
		TOTAL	169
DTC Programs 202,205	20 Feb - 20 May 196		
	DPG	N/A	3
		TOTAL	3
DTCTEST 68-50	September/October 1968		
	YAG-40	USS Granville S. Hall	127
		TOTAL	127
DTCTEST 69-10	May 69		
	LSD-30	USS Fort Snelling	786
		TOTAL	786
DTCTEST 69-31	August - September 196		
	DD-833	USS Thomas	313
		TOTAL	313
DTCTEST 69-32	30 April - 25 June 1969		
	YAG-40	USS Granville S. Hall	150
		TOTAL	150
Eager Belle II	February - March - June 1963		
	DD-825	USS Carpenter	261
	YAG-39	USS George Eastman	120
	YAG-40	USS Granville S. Hall	125
	APA-215	USS Navarro	394
	LST-1158	USS Tioga County	176
		TOTAL	1,076
Eager Belle I	January - March - 1963		
	YAG-40	USS Granville S. Hall	119
		TOTAL	119
Elk Hunt I	Jul - Aug 1964		
	DPG	N/A	6
		TOTAL	6
Elk Hunt Phase I & II	Jun - Aug 1964		
	Land Base	Land Base	111
		TOTAL	111

Errand Boy — September 6 - 15, 1965

YAG-39	USS George Eastman	95
	TOTAL	95

Fearless Johnny — August - September 1965

YAG-40	USS Granville S. Hall	133
YAG-39	USS George Eastman	128
	TOTAL	261

Flower Drum — Jan - Mar 1964

DPG	N/A	5
	TOTAL	5

Flower Drum I — February - April and August - September 1964

YAG-40	USS Granville S. Hall	139
YAG-39	USS George Eastman	129
	TOTAL	268

Folded Arrow — Apr - May 1966

YAG-40	USS Granville S. Hall	134
SS 337	USS Carbonero	118
	TOTAL	252

Green Mist — Mar - Apr 1967

DPG	N/A	46
	TOTAL	46

Half Nor — August - September 1966

SS 337	USS Carbonero	104
LT-2085	Light Tug 2085	1
YAG-39	USS George Eastman	133
YAG-40	USS Granville S. Hall	129
	TOTAL	367

High Low — 11 January - 26 February 1966

APA-220	USS Okanogan	329
DD-870	USS Fechteler	246
LST-1168	USS Wexford County	198
YAG-40	USS Granville S. Hall	6
DDG-15	USS Berkeley	341
	TOTAL	1,120

Magic Sword — May 1966

DPG	N/A	15
YAG-39	USS George Eastman	114
	TOTAL	129

Pine Ridge — May - June 1966

Land Base	Land Base	90
	TOTAL	90

Purple Sage — January - February 1966

DD-833	USS Thomas	310
	TOTAL	310

Red Oak — Apr - May 1966

DPG	N/A	24
	TOTAL	24

Scarlet Sage — February - 4 March 1966

DD-833	USS Thomas	356
	TOTAL	356

Shady Grove				
	LT	Light Tug		3
	LT-2080	Light Tug 2080		10
	LT-2081	Light Tug 2081		9
	DIV-40	Division 40		5
	LT-2086	Light Tug 2086		11
	LT-2087	Army Light Tug 2087		12
	YAG-40	USS Granville S. Hall		163
	LT-2085	Light Tug 2085		10
			TOTAL	223
Tall Timber				
	Land Base	Land Base		133
			TOTAL	133
West Side 1				
	DPG	N/A		29
			TOTAL	29
Yellow Leaf				
	DPG	N/A		184
			TOTAL	184

Total Personnel 5,842

Without SNs 358

Deseret Test Center/Project 112/SHAD
Fact Sheets and Cancellation Analysis Sheets
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FACT SHEET

Special Assistant to the Under Secretary of Defense
(Personnel and Readiness)for Gulf War Illnesses,
Medical Readiness and Military Deployments

For more information,
(703) 578-8500

Version 01-17-2002

Project Shipboard Hazard and Defense (SHAD)

Eager Belle, Phase I

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The primary purpose of the Eager Belle, Phase I test was to evaluate the effectiveness of selected protective devices in preventing penetration of a naval ship by a biological aerosol. An additional objective was to compare the efficiency of the M-17 and the Mark V protective masks against a biological aerosol. The USS *George Eastman* (YAG-39) was exposed to a biological tracer disseminated from a point source installed on a tugboat.

The biological tracer was Bacillus subtilis var. niger (often referred to as Bacillus globigii [BG]). For each trial, BG was aerosolized from an E-2 biological disseminator mounted on the stern of a tugboat. The BG was disseminated over a 10-minute period, during which 16 to 18 liters of agent were aerosolized. The USS *George Eastman* (YAG-39) maintained a distance of approximately 500 yards astern the tugboat. Fog oil was disseminated from an M3A3 pulse-jet mechanical smoke generator, prior to and concurrently with the BG, to provide a visible tracer to assist the captain of YAG-39 in remaining within the aerosol cloud.

Eager Belle, Phase I tests were conducted in an area of the Pacific Ocean west of Oahu, Hawaii within 40 miles of latitude 21? 30´ N, 158? 40´ W during the months of January and March 1963.

Test Name	Eager Belle, Phase I (Test 63-1)
Testing Organization	US Army Deseret Test Center
Test Dates	January, March 1963
Test Location	Testing was conducted in the Pacific Ocean, west of Oahu, Hawaii.
Test Operations	To evaluate the effectiveness of selected protective devices in preventing penetration of a naval ship by a biological aerosol.
Participating Services	US Navy, Deseret Test Center personnel
Units and Ships Involved	USS *George Eastman* (YAG-39)
Dissemination Procedures	Biological tracer released from an E-2 biological disseminator
Agents, Simulants, Tracers	Bacillus subtilis var. niger (Bacillus globigii [BG]).
Ancillary Testing	Mk V and M17 protective masks
Decontamination	Not identified.
Potential Health Risks Associated with Agents, Simulants, Tracers	Bacillus subtilis var. niger (Bacillus globigii [BG]) The American Type Culture Center characterizes Bacillus subtilis var. niger as a BioSafety Level-1 (BSL-1) bacterium. The Centers for Disease Control and Prevention define BSL-1 as suitable for work involving well-characterized agents not known to consistently cause disease in healthy adult humans. (Sources: American Type Culture Collection data sheet, *http://phage.atcc.org* [as of January 11, 2002] and *Biosafety in Microbiological and Biomedical Laboratories*, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention and National Institutes of Health, 4th ed., p. 17, April 1999, U.S. Government Printing Office, Washington)

FACT SHEET

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Version 01-17-2002

Project Shipboard Hazard and Defense (SHAD)

Eager Belle, Phase II

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The primary purpose of the Eager Belle, Phase II test was to study the downwind travel of biological aerosols. The primary test objectives were to relate biological cloud travel to predicted cloud travel based on prediction models for prevailing conditions; to obtain additional information on weapon system performance over the open sea under meteorological conditions encountered; and, to obtain information to assist in the design and execution of future trials. A secondary objective was to provide information on the performance of a particle-sized analyzer under environmental conditions.

Bacillus subtilis var. niger (often referred to as *Bacillus globigii* [BG]), a biological tracer, was released as a line source generated by Aero 14B spray tanks mounted on A-4 series jet attack aircraft. The ships which operated in Eager Belle, Phase II were the USS *George Eastman* (YAG-39), the USS *Carpenter* (DD-825), the USS *Navarro* (APA-215), and the USS *Tioga County* (LST-1185). The USS *Granville S. Hall* (YAG-40) and an EC-121 aircraft maintained operational control of testing.

Eager Belle, Phase II tests were conducted in an area of the Pacific Ocean approximately 175 miles west of Oahu, Hawaii within 100 miles radius of latitude 19° 30′ N, 160° 00′ W during the months of February, March, and June 1963.

Test Name	Eager Belle, Phase II (Test 63-1)
Testing Organization	US Army Deseret Test Center
Test Dates	February, March, June 1963
Test Location	Testing was conducted in the Pacific Ocean, west of Oahu, Hawaii.
Test Operations	To study the downwind travel of biological aerosols.
Participating Services	US Navy, Deseret Test Center personnel
Units and Ships Involved	USS *George Eastman* (YAG-39) USS *Granville S. Hall* (YAG-40) USS *Carpenter* (DD-825) USS *Navarro* (APA-215) USS *Tioga County* (LST-1185)
Dissemination Procedures	Biological tracer released as a line source generated by Aero 14B spray tanks mounted on A-4 series jet attack aircraft.
Agents, Simulants, Tracers	Bacillus globigii (Bacillus subtilis var. niger [BG]).
Ancillary Testing	Particle-sized analyzer under development
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Bacillus subtilis var. niger (Bacillus globigii [BG]) The American Type Culture Center characterizes Bacillus subtilis var. niger as a BioSafety Level-1 (BSL-1) bacterium. The Centers for Disease Control and Prevention define BSL-1 as suitable for work involving well-characterized agents not known to consistently cause disease in healthy adult humans. (Sources: American Type Culture Collection data sheet, *http://phage.atcc.org* [as of January 11, 2002] and *Biosafety in Microbiological and Biomedical Laboratories*, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention and National Institutes of Health, 4th ed., p. 17, April 1999, U.S. Government Printing Office, Washington)

FACT SHEET

Office of the Special Assistant to the
Under Secretary of Defense (Personnel and Readiness)
for Gulf War Illnesses, Medical Readiness
and Military Deployments

For more information,
(703) 578-8500

Version 01-31-2003

Project Shipboard Hazard and Defense (SHAD)

Autumn Gold

Project Shipboard Hazard and Defense (SHAD) was a program encompassing several tests undertaken in the 1960s to learn the vulnerabilities of US warships to an attack with chemical or biological warfare agents and develop procedures to respond to such an attack while maintaining a war-fighting capability.

The purpose of the Autumn Gold test program was to examine shipboard vulnerabilities and capabilities during a chemical or biological warfare agent attack. The test's primary objective was to determine the efficiency of shipboard protection systems such as detectors and decontaminants. The Autumn Gold test used a biological tracer.

According to the Autumn Gold test plan and final report, the crews who participated in the tests were not test subjects, but test conductors. Participants should have been fully informed of the details of each test. Before testing began, all persons involved in Autumn Gold should have received comprehensive biological and chemical agent training. Trial tests conducted before the actual test should have reinforced the training already received and ensured everyone involved knew their role in the test. The training program should have included training in the areas of using protective masks and clothing, medical training and immunizations, knowledge of chemical and biological agents and simulants, and knowledge of test procedures and processes. Under actual test conditions, test conductors should have worn appropriate nuclear, biological, and chemical (NBC) protective equipment and should have taken extensive safety precautions to prevent any adverse health effects from the testing.

Test Name	Autumn Gold (Test 63-2)
Testing Organization	US Army Deseret Test Center
Test Dates	May 3-31, 1963
Test Location	Testing was conducted on the open sea approximately 60 miles west-southwest of Oahu in the Hawaiian Islands
Test Operations	Three phases simulating stages of combat preparedness. Each phase consisted of three trials: Phase A. Defense against chemical and biological attack Phase B. Battle or near-battle condition. Phase C. Wartime or battle steaming.
Participating Services	US Navy, US Marines, plus Deseret Test Center personnel
Units and Ships Involved	A. USS *Navarro* (APA-215) B. USS *Tioga County* (LST-1158) C. USS *Carpenter* (DD-825) D. USS *Hoel* (DDG-13) E. USS *Granville S. Hall* (YAG-40) F. Marine Air Group 13, First Marine Brigade
Dissemination Procedures	Sprayed from A4B aircraft.
Agents, Simulants, Tracers	Bacillus globigii (BG). Harmless to humans, BG is ubiquitous and found easily in samplings of wind-borne dust. BG is safely used in biological studies as a stand-in for pathogenic bacteria. BG is used as a biological tracer for anthrax because its particle size and dispersal characteristics are similar to those of anthrax. A household bleach-and-water solution easily kills BG.
Ancillary Testing	M-17 and Navy's Mark IV protective masks
Decontamination	Water wash-down system (salt water), fire hoses (salt water), air wash by forced ventilation

FACT SHEET

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Version 10-09-2002

Deseret Test Center

Whistle Down

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

Whistle Down was primarily an investigation of the existence, nature, and extent of the hazard from Sarin nerve agent and VX nerve agent on environmental clothing, snow, and frozen ground.

Manikins dressed in arctic clothing and white camouflage overgarments were exposed downwind of the burst of Sarin-filled munitions as well as downwind of a detonated VX-filled M23 land mine.

Whistle Down was conducted at the Gerstle River test site, Fort Greely, Alaska, from December 1, 1962 to February 5, 1963.

Test Name	Whistle Down (DTC Test 63-3)
Testing Organization	US Army Deseret Test Center
Test Dates	December 1, 1962 – February 5, 1963
Test Location	Gerstle River test site, Fort Greely, Alaska
Test Operations	To investigate the existence, nature, and extent of the hazard from Sarin and VX nerve agents on environmental clothing, snow, and frozen ground.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Sarin-filled M55 rockets and M121 155mm shells,and VX-filled M23 land mines were remotely detonated.
Agents, Simulants, Tracers	Sarin Nerve Agent, VX Nerve Agent
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term

	health effects. (Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002] Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.) VX Nerve Agent – (Synonyms: Phosphonothioic acid, VX) VX nerve agent is extremely lethal. It is an oily liquid that is clear, odorless, and tasteless. Death usually occurs within 10 15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: constriction of pupils, headaches, runny nose, salivation, tightness in the chest, nausea, vomiting, anxiety, difficulty in thinking, muscle twitches, tremors, and weakness. With severe exposure, symptoms progress to convulsions and respiratory failure. There is little information available regarding the long-term human health effects of exposure to low doses of VX. (Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002] Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997. SBCCOM Online, Edgewood Chemical Biological Center http://in1.apgea.army.mil:80/RDA/msds/vx.htm [as of April 2, 2002]

	World Health Organization, Department of Sustainable Development & Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002] Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002])

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Version 10-31-2002

Deseret Test Center

Big Jack, Phase A

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of the Big Jack, Phase A test was to measure penetration of a jungle canopy by biological and chemical agent simulants disseminated from an operational weapon system.

The Big Jack program was divided into two phases. In Phase A trials, *Bacillus globigii*, a simulant for biological warfare agents, was released and sampled. The dissemination systems used were the US Air Force A/B45Y-1 and the US Navy Aero 14B spray tanks. The tanks were mounted on Marine A-4 aircraft.

A meteorological study using zinc cadmium sulfide (FP) was conducted during Big Jack, Phase A, to compare penetration of the jungle canopy by FP and the biological tracer.

The Big Jack, Phase A test area was located near the Fort Sherman Military Reservation, Panama Canal Zone. Big Jack, Phase A tests were conducted from February 15 – March 15, 1963.

Test Name	Big Jack, Phase A (DTC Test 63-4)
Testing Organization	US Army Deseret Test Center
Test Dates	February 15 – March 15, 1963
Test Location	Near Fort Sherman Military Reservation, Panama Canal Zone
Test Operations	To study the penetration of a jungle canopy by a biological aerosol generated by crosswind dissemination of a biological simulant from an elevated line source.
Participating Services	US Army, US Navy, US Air Force, Deseret Test Center personnel
Units and Ships Involved	VMA 225, Marine Aircraft Group 14
Dissemination Procedures	Sprayed from US Air Force A/B45Y-1 and US Navy Aero 14B spray tanks center mounted on Marine A-4 aircraft.
Agents	Not used
Simulants and Tracers	*Bacillus globigii* Zinc cadmium sulfide (FP)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger,* a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung,

heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection).

(Sources: Tuazon CU, *Other Bacillus Species* (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Zinc cadmium sulfide (ZCdS)

This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low.

(Sources: National Research Council (National Academies), Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu as of October 1, 2002.)

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Deseret Test Center

Big Jack, Phase B

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of the Big Jack, Phase B test was to obtain information on the degree of penetration of jungle canopy by a chemical warfare agent simulant disseminated from an operational type weapon system.

The Big Jack program was divided into two phases. Phase B trials involved the release and sampling of tri (2-ethylhexyl) phosphate (TOF), a non-toxic simulant for VX nerve agent. The dissemination systems used were the US Navy Aero 14B and E40 spray tanks mounted on Marine A-4 aircraft

The Big Jack, Phase B test area was located on the Fort Sherman Military reservation, Panama Canal Zone. Big Jack, Phase B trials were conducted from February 15 - March 9, 1963.

Test Name	Big Jack, Phase B (DTC Test 63-4)
Testing Organization	US Army Deseret Test Center
Test Dates	February 15 - March 9, 1963
Test Location	Near Fort Sherman Military Reservation, Panama Canal Zone
Test Operations	To investigate the penetration and dispersion of a simulant for VX nerve agent when released as an aerial spray over a jungle environment.
Participating Services	US Army, US Navy, US Air Force, Deseret Test Center personnel
Units and Ships Involved	VMA 225, Marine Aircraft Group 14
Dissemination Procedures	Sprayed from US Navy Aero 14B and E40 tanks mounted on Marine A-4 aircraft
Agents	Not used
Simulants and Tracers	tri (2-ethylhexyl) phosphate
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	trioctyl phosphate (tri (2-ethylhexyl) phosphate) (TOF) Used as a nontoxic simulant for VX nerve agent. TOF is a viscous, colorless or pale yellow liquid. It can irritate the eyes, skin, and respiratory tract on contact. It can cause cancer in some animal species, but this has not been demonstrated in humans. (Sources: NLM TOXNET, Trioctyl phosphate 1806-54-8 or Tri(2-ethylhexyl)phosphate 78-42-2, HSDB Human Health Effects and

	Animal Toxicity Studies, available at *http://toxnet.nlm.nih.gov*. *http://physchem.ox.ac.uk/MSDS/TR/tris(2-ethylhexyl)phosphate.html* [as of September 25, 2002] and *http://www.ilo.org/public/english/protection/safework/cis/products/icsc/dtasht/_icsc09/icsc0968.pdf* [as of September 25, 2002]).

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Version 06-05-2003

Deseret Test Center
Project SHAD

Errand Boy

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The Deseret Test Center (DTC) studied the relative efficiency of shipboard collective protection and ventilation systems against a biological agent-simulant in Eager Belle (DTC Test 63-1). Errand Boy was originally designed as an extension of the Eager Belle and Autumn Gold (DTC Test 63-2) tests to obtain similar data on ships exposed to a toxic environment. DTC selected *Pasteurella tularensis* and *Venezuelan equine encephlomyelitis* as representative agents to be used in Errand Boy.

The original objectives of Errand Boy were to determine the degree biological agent aerosols penetrate a ship's interior and the extent of any associated surface contamination hazard under various combinations of shipboard collective protection and ventilation systems; and to evaluate the effectiveness of various decontamination procedures for decontaminating exterior surfaces.

The penetration phase of the test was not conducted. Consequently, the biological agents *Pasteurella tularensis* and *Venezuelan equine encephlomyelitis* were not used; however, decontamination procedures were conducted.

Before each decontamination trial, sample patches impregnated with known numbers of *Bacillus globigii* microorganisms were set out in the ship's zone being tested. Their purpose was to check the effectiveness of the decontamination. Personnel who performed decontamination functions wore impermeable (rubber) clothing. The zone was closed to all other personnel. Teams disseminated betapropriolactone when decontaminating each zone; a standard dissemination time of 80 minutes was employed in all zones.

Seven trials were scheduled for the decontamination phase from September 6 through 13, 1963. An additional trial was conducted on September 17, bringing the total of trials to eight for this test phase which was conducted aboard the USS *George Eastman* (YAG-39), while moored at Buoy X-9 in East Loch, Pearl Harbor, Oahu, Hawaii.

Test Name	Errand Boy (DTC 64-1)
Testing Organization	US Army Deseret Test Center
Test Dates	September 6 – 17, 1963
Test Location	Buoy X-9 in East Loch, Pearl Harbor, Oahu, Hawaii
Test Operations	To evaluate the effectiveness of various decontamination procedures for decontaminating exterior surfaces.
Participating Services	US Army, US Navy, US Air Force, Deseret Test Center personnel
Units and Ships Involved	USS *George Eastman* (YAG-39)
Dissemination Procedures	Control sample patches impregnated with known numbers of *Bacillus globigii* microorganisms were set out in the ship's zone being decontaminated.
Agents, Simulants, Tracers	*Bacillus globigii*
Ancillary Testing	Not identified
Decontamination	Teams disseminated betapropriolactone when decontaminating each zone; a standard dissemination time of 80 minutes was employed in all zones.
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* Now considered to be *Bacillus subtilis var. niger,* a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but

always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection).(Sources: Tuazon CU, *Other Bacillus Species* (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Betapropriolactone

Modern uses for betapropriolactone include vaccines, enzymes, tissue grafts, and surgical instruments; to sterilize blood plasma, water, milk, and nutrient broth; and as a vapor-phase disinfectant in enclosed spaces. Its sporicidal action kills vegetative bacteria, pathogenic fungi, and viruses. The primary routes of potential human exposure to betapropriolactone are inhalation, ingestion, and dermal contact. There is evidence betapropriolactone is a carcinogen; however, the results of animal testing in mice, rats, hamsters, and guinea pigs are questionable due to a lack of controls in the study. An International Agency for Research on Cancer (IARC) working group reported no data are available to evaluate the carcinogenicity of betapropriolactone in humans.(Source: Department of Health and Human Services, National Institutes of Health website: http://ntp-server.niehs.nih.gov/htdocs/8_RoC/RAC/betapropriolactone.html).

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Project Shipboard Hazard and Defense (SHAD)

Flower Drum, Phase I

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The purposes of the Flower Drum, Phase I test were to find a simulant to sarin nerve agent, to assess shipboard vulnerability to an enveloping vapor of toxic agent, and to establish comparative penetration properties for sarin nerve agent simulant and actual agent. The USS *George Eastman* (YAG-39) was exposed to candidate sarin nerve agent simulants as well as sarin nerve agent. The ship was enveloped by the test agent disseminated from a gas turbine mounted on the bow of the test ship and by simulated envelopment—direct injection of the test agent into the air supply system.

Trials of candidate simulants sulfur dioxide and methylacetoacetate were run to determine usability as a simulant for sarin nerve agent. Methylacetoacetate was selected and further subjected to comprehensive, comparative tests.

During sarin nerve agent dissemination, the disseminator crew wore M5 protective ensembles and all other personnel (those in the Safety Citadel) wore MK5, M7A1, or M17 protective masks. When dissemination ceased, all personnel whose duties required them to leave the Safety Citadel wore protective masks until the ship was cleared of nerve agent. During the dissemination period of the simulant trials, all personnel wore protective masks. During test periods, the only entrance to or exit from the Safety Citadel was through a decontamination tunnel consisting of a passageway that functioned as an air-sweep tunnel for the decontamination facility and also as one of two primary ventilation exhausts for the Safety Citadel. The passageway was divided into four sections by perforated doors; the doors restricted the rate of airflow and maintained the interior/exterior pressure differential. The decontamination tunnel was outfitted with a gas chamber to be used for a protective mask check, shower facilities (not used during the test of vapor agents), and

protective equipment and clothing removal facilities. All personnel worked in teams of two or more persons and all teams were checked in and out of the Safety Citadel.

Following the termination of sampling, a full aeration of the ship was accomplished. For the sarin nerve agent trials, aeration of the ship continued until the enzyme ticket test of the M15A1 Detector Kit indicated there was no nerve agent in the exhaust air. When negative results were obtained at the exhaust vents, properly protected personnel confirmed the absence of sarin nerve agent within each area—again using the enzyme ticket test of the M15A1 Detector Kit.

Flower Drum, Phase I, tests were conducted in the Pacific Ocean, off the coast of Hawaii, over the periods February through April and August through September 1964.

Test Name	Flower Drum, Phase I (Test 64-2)
Testing Organization	US Army Deseret Test Center
Test Dates	February through April and August through September 1964
Test Location	Testing was conducted in the Pacific Ocean, off the coast of Hawaii.
Test Operations	To find a simulant to sarin nerve agent, to assess shipboard vulnerability to an enveloping vapor of toxic agent, and to establish comparative penetration properties for sarin nerve agent simulant and agent.
Participating Services	US Navy, Deseret Test Center personnel
Units and Ships Involved	USS *George Eastman* (YAG-39) USS *Granville S. Hall* (YAG-40)
Dissemination Procedures	The ship was enveloped by test agent disseminated from a modified Model T-45M-2 MARS Portable Gas Turbine mounted on the bow of the test ship and by simulated envelopment—direct injection of test agent into the air supply system.
Agents, Simulants, Tracers	Sarin (GB) Sulfur dioxide (SO2) Methylacetoacetate (MAA)

Ancillary Testing	E41 V-G Agent Alarm System Hydrogen Flame Emission Detector (HYFED) Passive Long Path Infrared (LOPAIR) advance warning alarm
Decontamination	A decontamination tunnel was used during test periods.
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin (GB) Sarin gas is classified by the Centers for Disease Control and Prevention as a volatile and lethal nerve agent. Occupational Exposure limits are .0001mg/m^3. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. Symptoms may occur within minutes depending on dose and include runny nose, watery eyes, drooling, tightness of the chest, difficulty breathing, dimness of vision, nausea, vomiting, cramps, loss of bladder/bowel control, twitching, jerking, staggering, confusion, drowsiness, coma, and death. Very little information is available regarding prolonged exposures to low levels and no information is available regarding potential carcinogenicity. Rapid decontamination is critical and administration of atropine every 5-10 minutes is necessary until symptoms are minimized. Complete recovery can take months and permanent damage to central nervous system is possible. (Source: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002]). Sulfur Dioxide (SO2) Sulfur dioxide is a strong irritant of the lungs and throat. Internal exposure causes headache, dizziness, nausea, wheezing, and cough. External exposure causes severe irritation of eyes, nose, throat, and blisters on skin. Exposures to sulfur dioxide may lawfully range from 0 to 5 parts per million (ppm) of air. Exposure to 100 ppm of

	sulfur dioxide is considered immediately dangerous to life and health. (Source: ATSDR Toxicological Profile for Sulfur Dioxide www.atsdr.cdc.gov/toxprofiles/tp116.html [as of February 13, 2002]). Methylacetoacetate (Synonyms: methyl acetoacetate, acetoacetic acid, methyl ester) Potential health effects consist of low to moderate eye, skin and respiratory tract irritation and possible gastrointestinal irritation with nausea, vomiting, and diarrhea. EPA does not consider methylacetoacetate to be a hazardous material. It is not a known carcinogen. (Sources: http://hazard.com/msds/tox/f/q4/q936.html [as of January 28, 2002] and http://www.hbcollege/chem/lab/organic/gilbert3e/resources/studenttools/dl/e_mmsds.pdf

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Project Shipboard Hazard and Defense (SHAD)

Flower Drum, Phase II

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The primary purpose of the Flower Drum, Phase II, test was to determine the effectiveness of a shipboard water washdown system as a protective and decontaminant measure against simulated aerial delivery of VX nerve agent spray.

The US Navy Covered Lighter (Barge), YFN-811, was used as the platform for the test. During the test trials, the barge was towed by the US Navy Tug, ATF 105. It was towed approximately one kilometer behind the tug. A spray device on the barge disseminated agent or simulant onto the barge during tests.

A dyed liquid containing approximately 90 percent VX nerve agent (by weight) was used in this program. To assist in taking radiometric measurements of contamination, radioactive "tagged VX nerve agent" molecules containing a radioactive isotope, Phosphorous 32, were included in the agent. In addition to VX nerve agent, a simulant, Bis (2 ethyl-hexyl) hydrogen phosphite was used in this test.

Flower Drum, Phase II, tests were conducted at sea during November and December 1964, off the coast of Hawaii.

Test Name	Flower Drum, Phase II (Test 64-2)
Testing Organization	US Army Deseret Test Center
Test Dates	November and December 1964
Test Location	Testing was conducted in the Pacific Ocean, off the coast of Hawaii.
Test Operations	To determine the effectiveness of a shipboard water washdown system as a protective and decontaminant measure against simulated aerial delivery of VX nerve agent spray.
Participating Services	US Navy, plus Deseret Test Center personnel
Units and Ships Involved	US Navy Covered Lighter (Barge), YFN-811 US Navy Tug, ATF-105
Dissemination Procedures	A dyed liquid containing approximately 90 percent VX nerve agent (by weight) was sprayed onto the barge. To assist in taking radiometric measurements of contamination, radioactive "tagged VX nerve agent" molecules containing a radioactive isotope, Phosphorous 32, were included in the agent.
Agents, Simulants, Tracers	VX nerve agent VX nerve agent containing radioactive isotope, Phosphorous 32 Bis (2 ethyl-hexyl) hydrogen phosphite
Ancillary Testing	Not identified
Decontamination	Water washdown system
Potential Health Risks Associated with Agents, Simulants, Tracers	VX Nerve Agent – Lethal Nerve Agent (Synonyms: Phosphonothioic acid, VX): VX is an extremely lethal nerve agent. It is an oily liquid that is clear, odorless and tasteless. Death usually occurs within 10-15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: miosis (constriction of pupils) and visual effects, headaches and pressure sensation, runny nose and nasal congestion, salivation, tightness in the chest, nausea, vomiting, giddiness, anxiety, difficulty in

	thinking, difficulty sleeping, nightmares, muscle twitches, tremors, weakness, abdominal cramps, diarrhea, involuntary urination and defecation. With severe exposure symptoms progress to convulsions and respiratory failure. The permissible airborne exposure concentration for VX nerve agent in any 8-hour work shift can be found in Department of the Army Pamphlet 40-8. To date, however, the Occupational Safety and Health Administration has not promulgated a permissible exposure concentration for VX nerve agent. (Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002]. *SBCCOM Online*, Edgewood Chemical Biological Center [ECBC], http://www.sbccom.apgea.army.mil/RDA/msds/vx.htm [as of April 2, 2002]. Department of Sustainable Development and Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002]). Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX, http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002]). Phosphorous 32 Phosphorous 32 is one of the highest energy beta-emitting radionuclides commonly used in biomedical research. In general Phosphorous 32 does not pose a severe threat from ingestion or inhalation. High energy betas from Phosphorous 32 pose an external (skin and lens of the eye) dose hazard, as well as a potential internal hazard. Radiogenic health effects (primarily cancer) are observed in humans only at doses in excess of 10 rem delivered at high dose rates. Below this dose, estimation of adverse health effects is speculative. Exposure can contribute to development of cancer. (Sources: Environmental Protection Agency, http://www.epa.gov/radiation/heast/docs/heast2_table_4-d2_0401.pdf. [as of February 28, 2002], Harvard University, http://www.uos.harvard.edu/ehs/radsafety/gui_p32.shtml.[as of February 28, 2002] Cornell University, http://msds.pdc.cornell.edu/msds/siri/msds/h/q428/q236.html [as of February 28, 2002]. Office of Radiation, Chemical and Biological Safety,

	MSU. http://www.orcbs.msu.edu/radiation/radsaf.html [as of February 28, 2002] University of California, Davis, http://ehs.ucdavis.edu/hp/shi/haz_sh.html [as of February 28, 12002]. University of Iowa, http://www.uiowa.edu/~hpo/facts/P32.htm [as of February 28, 2002]). Bis (2 ethyl-hexyl) hydrogen phosphite May be harmful by inhalation, ingestion, or skin absorption. Vapor or mist can be irritating to the eyes, mucous membranes, and upper respiratory tract. It can also cause skin irritation. It is not carcinogenic and there are no chronic exposure hazards. (Source: Cornell University, http://msds.pdc.cornell.edu/msds/siri/msds/h/q324/q431.html [as of February 28, 2002]).

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Version 09-13-2001

Project Shipboard Hazard and Defense (SHAD)

Shady Grove

Project Shipboard Hazard and Defense (SHAD) was a program encompassing several tests undertaken in the 1960s to learn the vulnerabilities of US warships to an attack with chemical or biological warfare agents and develop procedures to respond to such an attack while maintaining a war-fighting capability.

Shady Grove testing, conducted in the Pacific Ocean in 1965, was an extension of the Autumn Gold test series. The primary difference between Autumn Gold and Shady Grove is that in the latter tests actual agents were used in addition to simulants.

The crews who participated in Shady Grove were not test subjects, but test conductors. Participants should have been fully informed of the details of each test. Before testing began, all persons involved in Shady Grove should have received comprehensive biological and chemical agent training. Trial tests conducted before the actual test should have reinforced the training already received and ensured everyone involved knew their role in the test. The training program should have included training in these areas: using protective masks and clothing, medical training and immunizations, knowledge of chemical and biological agents and simulants, and knowledge of test procedures and processes. Under actual test conditions, test conductors should have worn appropriate nuclear, biological, and chemical (NBC) protective equipment and should have taken extensive safety precautions to prevent any adverse health effects from the testing.

Test Name	Shady Grove (Test 64-4)
Testing Organization	US Army Deseret Test Center
Test Dates	January 22 through April 9, 1965
Test Location	Various open water locations of the Pacific Ocean
Test Operations	Target ship operated under three different readiness conditions: 1. Normal steaming conditions—full ventilation 2. Battle or near-battle condition 3. Chemical or biological attack expected
Participating Services	US Navy, US Marines, plus Deseret Test Center personnel
Units and Ships Involved	A. USS *Granville S. Hall* (YAG-40) B. Army light tugs 2080, 2081, 2085, 2086, and 2087, all staffed by USN personnel C. Marine Air Group 13, First Marine Brigade
Dissemination Procedures	Sprayed from A4B aircraft
Agents, Simulants, Tracers	Bacillus globigii (BG). Harmless to humans, BG is ubiquitous and easily found in samplings of wind-borne dust. BG is safely used in biological studies as a stand-in for pathogenic bacteria. BG is used as a biological tracer for anthrax because its particle size and dispersal characteristics are similar to those of anthrax. A household bleach and water solution easily kills BG. Coxiella burnetii (OU). Until the stockpile was destroyed in 1972, OU was part of the US biological weapons stockpile. OU causes Q fever in humans. Domestic animals (cattle, sheep, and goats), cats, wild animals, and ticks usually host OU. Humans become infected after contact with contaminated materials (feces, blood, placenta, etc.); inhaling contaminated dust or droplets; or ingesting contaminated food or raw (unpasteurized) milk. Symptoms of the disease include fever, headache,

	muscle pains, joint pain (arthralgia), and a dry, on-productive cough. Hepatitis or pneumonia also may develop during the early stages of the disease. In rare occurrences, Q fever can cause severe complications in the aortic heart valve (and subsequent endocarditis). Generally, victims recover even without treatment. However, complications, if they ensue, can be very serious and sometimes even life-threatening. (Sources: Mitretek Systems web site http://www.mitretek.org/mission/envene/biological/agents/rickettsia.html and Dr. Koop's web site http://www.drkoop.com/conditions/ency/ Pasteurella tularensis (UL). UL causes the infectious disease tularemia (rabbit fever, deer fly fever, Ohara's disease), most commonly in people who handle infected wild rabbits. Other infected animals, ticks, or contaminated food or water also transmit tularemia. The symptoms, high fever and severe constitutional distress, appear suddenly within 10 days of exposure. One (or more) ulcerating lesion develops at the site of infection, such as the arm, eye, or mouth. The regional lymph nodes enlarge, suppurate, and drain. Pneumonia, meningitis, or peritonitis may complicate the infection, whose mortality rate is about 6 percent. (Sources: Colorado State University, Environmental Health Services web site http://www.ehs.colostate.edu/biosafety/LARmanual/tular.htm and The Columbia Encyclopedia, 6th ed., New York: Columbia University Press, 2001, web site http://www.bartleby.com/65/tu/tularemi.html/.
Ancillary Testing	Aero 14-B spray tank
Decontamination	Not identified

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Deseret Test Center

Night Train

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The primary purpose of Night Train was to study the penetration of an arctic inversion by a biological aerosol cloud. A secondary purpose was to study the downwind travel and diffusion of this cloud when disseminated into different arctic meteorological regimes.

A total of 14 trials were conducted in which the biological simulant *Bacillus globigii* was released from an A/B45Y-1 spray tank carried on an F-105 or F-100 aircraft. Four trials were surface trials in which dry *Bacillus globigii* was disseminated from the rear of a moving, M116 Personnel Carrier. In addition, biological release was accompanied by the release of two colors (yellow and green) of fluorescent particles of zinc cadmium sulfide. The fluorescent particles were released from contractor-flown aircraft. The yellow fluorescent particles were disseminated from an Aero Commander aircraft; the green fluorescent particles from a Cessna 180.

Night Train was conducted in the vicinity of Fort Greely, Alaska during the period November 30, 1963 to January 8, 1964.

Test Name	Night Train (DTC Test 64-5)
Testing Organization	US Army Deseret Test Center
Test Dates	November 30, 1963 – January 8, 1964
Test Location	Near Fort Greely, Alaska
Test Operations	To obtain data on the downwind travel of a biological agent simulant under arctic conditions, when disseminated from the A/B 45Y-1 wet biological spray tank mounted on an operational aircraft and when sprayed from a tracked vehicle mounted dissemination device.
Participating Services	US Army, US Air Force, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Biological simulant *Bacillus globigii* was released from an A/B45Y-1 spray tank carried on an F-105 or F-100 aircraft. In surface trials, *Bacillus globigii* was disseminated from the rear of a moving, tracked vehicle. Fluorescent particles were released from contractor-flown aircraft (Aero Commander - yellow particles and Cessna 180 - green particles).
Agents, Simulants, Tracers	*Bacillus globigii,* Zinc Cadmium Sulfide
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger,* a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the

	environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection). (Sources: Tuazon CU, *Other Bacillus Species* (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.) Zinc cadmium sulfide (ZCdS) This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low. (Sources: National Research Council (National Academies), Toxicologic Assessment of the Army's

	Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu as of October 1, 2002.)

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Deseret Test Center

Yellow Leaf

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The first objective of the Yellow Leaf test was to determine the effectiveness of the M143 bomblet when employed against targets in a jungle environment. The second objective was to determine mathematically, and based on data obtained from the Yellow Leaf test, the area coverage to be expected from the detonation of a US Navy MISTEYE I weapons system or a US Army SERGEANT M211 biological warhead over a jungle canopy. An additional objective was to gather information relative to the effects of precipitation on a biological aerosol moving under a jungle canopy.

Yellow Leaf, Phase A was conducted to measure height of burst characteristics for the M143 bomblet. Bomblets filled with tiara, a gelatinous simulant that fluoresces, were individually fired into jungle canopy. There were 185 Phase A trials conducted on the Fort Sherman Military Reservation, Panama Canal Zone and an additional 100 Phase A trials conducted on the Island of Hawaii. Phase B, conducted on the Island of Hawaii, consisted of 20 trials to measure cloud diffusion characteristics under a jungle canopy. The biological simulant *Bacillus globigii* was used as fill in the M143 bomblets detonated during the Phase B trials.

Initial testing was conducted in February 1964 at the Fort Sherman Military Reservation, Panama Canal Zone. However, before Yellow Leaf trials could be completed, international considerations forced the Deseret Test Center to terminate the testing program at that location. To complete the program, a substitute jungle site was chosen on the Island of Hawaii. The remaining trials were conducted on the Island of Hawaii in the Olaa Forest, southwest of Hilo during April and May 1966.

Test Name	Yellow Leaf (DTC Test 64-6)
Testing Organization	US Army Deseret Test Center
Test Dates	February 1964 (Panama Canal Zone) April – May 1966 (Hawaii)
Test Location	Fort Sherman Military Reservation, Panama Canal Zone (February 1964) Island of Hawaii (April – May 1966)
Test Operations	To measure burst height and cloud diffusion characteristics of the M143 bomblet when released into a jungle canopy.
Participating Services	Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	M143 bomblets statically detonated above jungle canopy.
Agents	Not used
Simulants and Tracers	*Bacillus globigii* (Hawaii) Tiara (Panama Canal Zone and Hawaii)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger*, a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but

	always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection). (Sources: Tuazon CU, *Other Bacillus Species* (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.) Tiara is a luminescent gelatinous material. No further information is available on this substance.

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Deseret Test Center

Tall Timber

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of Tall Timber was to test the effectiveness of the M138 bomblet filled with agent BZ in a tropical forested environment. BZ is a code name for an ester of benzilic acid. The chemical affects the human mind causing those contaminated to be unable to perform an assignment or have a reduced will to resist for a short period of time.

M138 bomblets filled with agent BZ were statically-ignited in a test area in the upper Waiakea Forest Reserve, southwest of Hilo, on the island of Hawaii during the period April through June 1966.

Test Name	Tall Timber (DTC Test 64-8)
Testing Organization	US Army Deseret Test Center
Test Dates	April – June 1966
Test Location	Island of Hawaii
Test Operations	To test the effectiveness of the BZ-agent filled M138 bomblet in a tropical forested environment.
Participating Services	Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Statically-ignited M138 bomblets filled with agent BZ
Agents, Simulants, Tracers	Ester of benzilic acid (BZ)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Ester of benzilic acid (Agent BZ) This chemical is an incapacitating agent designed to cause stupor, confusion, and hallucinations when inhaled or absorbed through the skin. It is a white powder and may irritate the eyes, skin, and digestive and respiratory tracts, if inhaled or ingested. While some effects may last several days or weeks, long-term or late-developing health effects have not been documented and seem unlikely. (Source: Incapacitating Agents (chap. 5), in US Army Medical Research Institute of Chemical Defense, Medical Management of Chemical Casualties Handbook, 3rd edition, 1998; Ketchum JS, Sidell FR Incapacitating Agents (chap. 11), in ed. Zajtchuk R., Textbook of Military Medicine (part 1), Medical Aspects of Chemical and Biological

	Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997. http://www.fas.org/nuke/guide/russia/cbw/jptac008_194001.html [as of September 25, 2002].)

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Version 09-13-2001

Project Shipboard Hazard and Defense (SHAD)
Copper Head

Project Shipboard Hazard and Defense (SHAD) was a program encompassing several tests undertaken in the 1960s to learn the vulnerabilities of US warships to an attack with chemical or biological warfare agents and develop procedures to respond to such an attack while maintaining a war-fighting capability.

Copper Head testing was similar to Autumn Gold testing in that the test used simulants only. The primary difference between Copper Head and Autumn Gold was Copper Head was designed to use simulants to learn biological agents' characteristics in frigid temperatures. Copper Head was conducted in international waters in the North Atlantic.

The crews who participated in Copper Head were not test subjects, but test conductors. Participants should have been fully informed of the details of each test. Before testing began, all persons involved in Copper Head should have received comprehensive biological and chemical agent training. Trial tests conducted before the actual test should have reinforced the training already received and ensured everyone involved knew their role in the test. The training program should have included training in these areas: using protective masks and clothing, medical training and immunizations, knowledge of chemical and biological agents and simulants, and knowledge of test procedures and processes. Under actual test conditions, test conductors should have worn appropriate nuclear, biological, and chemical (NBC) protective equipment and should have taken extensive safety precautions to prevent any adverse health effects from the testing.

Test Name	Copper Head (Test 65-1)
Testing Organization	US Army Deseret Test Center
Test Dates	January 24 through February 25, 1965
Test Location	Atlantic Ocean, off the coast of Newfoundland, Canada
Test Operations	Target ship was operated under three different readiness conditions: A. Normal steaming conditions — full ventilation B. Battle or near-battle condition C. Chemical and biological attack expected
Participating Services	US Navy, US Marines, plus Deseret Test Center personnel
Units and Ships Involved	USS Power (DD-839)
Dissemination Procedures	Sprayed from A4B aircraft.
Dissemination Procedures	Dissemination in all trials was from E2-type nozzles with suitable pressurizing equipment. Above canopy releases were made from a 32-meter tower using equipment and procedures similar to ground-release trials.
Agents, Simulants, Tracers	*Bacillus globigii* (BG) *Serratia marcescens* (SM) *Escherichia coli* Fluorescent particles (FP)
Ancillary Testing	Aero 14-B spray tank
Decontamination	Exterior: Not documented. Interior: Betapropiolactone (b-Propiolactone). Modern uses for b-propiolactone include vaccines, enzymes, tissue grafts, and surgical instruments; to sterilize blood plasma, water, milk, and nutrient broth; and as a vapor-phase disinfectant in enclosed spaces. Its sporicidal action kills vegetative bacteria, pathogenic fungi, and viruses. The primary routes of potential human exposure to b-propiolactone are inhalation, ingestion, and dermal contact. There is

	evidence b-propiolactone is a carcinogen. However, the results of animal testing in mice, rats, hamsters, and guinea pigs are questionable due to a lack of controls in the study. An International Agency for Research on Cancer (IARC) working group reported no data are available to evaluate the carcinogenicity of b-propiolactone in humans. (Source: Department of Health and Human Services, National Institutes of Health web site: http://ntp-server.niehs.nih.gov/htdocs/8_RoC/RAC/betaPropiolactone.html.)
Agents, Simulants, Tracers	Bacillus globigii (BG). Harmless to humans, BG is ubiquitous and easily found in samplings of wind-borne dust. BG is safely used in biological studies as a stand-in for pathogenic bacteria. BG is used as a biological tracer for anthrax because its particle size and dispersal characteristics are similar to those of anthrax. A household bleach and water solution easily kills BG. Zinc Cadmium Sulfide (FP – fluorescent particle). Zinc cadmium sulfide is an inorganic compound. Although it is not a biologic weapon, it is used as a tracer to simulate biological weapons' dispersion in various environments. In the early 90's, in response to concerns about cancer and infertility, the National Research Council studied the compound's long-term effects. The Council's findings indicate zinc cadmium sulfide is not harmful to humans. It is a stable compound; strong acids dissolve it only slightly. Because zinc cadmium sulfide does not dissolve in water or fats, it is unlikely it can enter the body through cutaneous contact or inhalation. Cadmium is the most toxic element of the compound. Humans are exposed to cadmium naturally in water, air, food, soil and house dust. It enters the air from burned coal and household waste. There have been no studies on the toxic effects of

	repeated exposure to zinc cadmium sulfide. The National Research Council devised a worst-case scenario: if exposure to zinc cadmium sulfide has the same effect as exposure to an equal amount of cadmium, repeated exposures to zinc cadmium sulfide could be toxic to kidneys and bones and cause lung cancer. Currently, no medical test determines exposure to zinc cadmium sulfide. However, tests are available to determine cadmium exposure. After 30 to 40 years it would be hard to identify people exposed or affected and determine their past exposures to zinc cadmium sulfide. (Source: National Academy Press, Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, 1997, web site: http://books.nap.edu/books/0309057833/html/R13.html#pagetop.)

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Deseret Test Center

West Side, Phase I

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of West Side, Phase I was to evaluate the A/B 45Y-4 dry agent disseminator in a frigid environment. The A/B 45Y-4 was wing-mounted on an F-105D aircraft. Specifically, the objectives of the test were to evaluate the source strength, dissemination efficiency, and functional characteristics of the dry disseminator with the simulant *Bacillus globigii*, and to measure the diffusion of particulate biological aerosols disseminated by line source in a cold-weather test environment. To aid this investigation, two tracer materials – green and yellow zinc cadmium sulfide (FP) – were disseminated from a light aircraft under similar test conditions.

West Side, Phase I was conducted in the Tanana Valley of central Alaska, near Fort Greely, during the period January 8 through February 21, 1965.

Test Name	West Side, Phase I (DTC Test 65-3)
Testing Organization	US Army Deseret Test Center
Test Dates	January 8 – February 21, 1965
Test Location	Tanana Valley of central Alaska near Fort Greely
Test Operations	To evaluate the A/B 45Y-4 dry agent disseminator in a frigid environment.
Participating Services	US Army, US Air Force, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Tracer material sprayed from an A/B 45Y 4 disseminator tank mounted on an F 105D aircraft.
Agents, Simulants, Tracers	*Bacillus globigii* Zinc Cadmium Sulfide (FP)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger*, a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection).

	(Sources: Tuazon CU, *Other Bacillus Species* (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.) Zinc cadmium sulfide (ZCdS) This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low. (Sources: National Research Council (National Academies), Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu as of October 1, 2002.)

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Deseret Test Center
Project SHAD

Magic Sword

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' and ashore installations' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The purpose of Magic Sword was to study the feasibility of an offshore release of *Aedes aegypti* mosquitoes and to obtain information on mosquito biting habits, mosquito trap technology, and operational and logistical problems associated with the delivery of mosquitoes to remote sites.

The *Aedes aegypti* mosquito is a main vector for various infectious diseases, including dengue and yellow fevers.

Uninfected mosquitoes were released from the USS *George Eastman* (YAG-39), off the coast of Baker Island and traps were placed on the island as part of the test. As part of an onshore biting study, volunteers were placed at specific locations and a designated number of vectors were released centrally. Volunteers recorded the number of bites received.

A thermal fog generator was used to eradicate the mosquito population on the island at the conclusion of the test. Mosquitoes were eradicated aboard ship through a combination of high heat and insecticide.

The trials for Magic Sword were conducted in the Pacific Ocean, on or in the vicinity of Baker Island, during May 1965.

Test Name	Magic Sword (DTC Test 65-4)
Testing Organization	US Army Deseret Test Center
Test Dates	May 1965
Test Location	In the Pacific Ocean, on or in the vicinity of Baker Island
Test Operations	To study the feasibility of an offshore release of *Aedes aegypti* mosquitoes and to obtain information on mosquito biting habits, mosquito trap technology, and operational and logistical problems associated with the delivery of mosquitoes to remote sites.
Participating Services	US Navy, Deseret Test Center personnel
Units and Ships Involved	USS *George Eastman* (YAG-39)
Dissemination Procedures	Mosquitoes were released from the USS *George Eastman* near the coast of Baker Island.
Agents, Simulants, Tracers	Uninfected *Aedes aegypti* (mosquitoes).
Ancillary Testing	Not identified.
Decontamination	A thermal fog generator was used o eradicate the mosquito population on the island at the conclusion of the test. Mosquitoes were eradicated aboard ship through a combination of high heat and insecticide.
Potential Health Risks Associated with Agents, Simulants, Tracers	*Aedes aegypti* mosquitoes *Aedes aegypti* mosquitoes used in this test were not infected. Health effects at the time would be the usual swelling and irritation associated with mosquito bites. No long-term or latent effects would be expected.

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Version 06-30-2003

Deseret Test Center
Project SHAD

Big Tom

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' and ashore installations' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The purpose of Big Tom was to evaluate the feasibility of a biological attack against an island complex and to evaluate doctrine and tactics for delivery of such an attack.

Test personnel investigated the diffusion and downwind travel of biological simulant and tracer aerosols; estimated area coverage in both jungle and surrounding tropical terrain; investigated the degree of aerosol penetration of a jungle canopy, ventilation rate, and time resolution of aerosols; and, investigated the degree of penetration and aerosol time resolution of typical fortifications.

The test consisted of a series of line-source trials during which a biological simulant, *Bacillus globigii*, was disseminated from a high performance aircraft and from the US Navy fleet submarine, USS *Carbonero* (SS-337). Both liquid and dry *Bacillus globigii* were used in

this test. Liquid *Bacillus globigii* was disseminated from an Aero 14B spray tank mounted on a US Navy A-4 aircraft. Dry *Bacillus globigii* was disseminated from an A/B Y45-4 spray tank mounted on a US Air Force F-105 aircraft. *Bacillus globigii* was released from the USS *Carbonero* using a submarine-biological-disseminator. Aerosol sampling was done at various land-based stations.

For this test, a contractor-flown Aero Commander aircraft also released two colors (yellow and green) of fluorescent particles of zinc cadmium sulfide (FP).

Big Tom was conducted on the island of Oahu, Hawaii and its surrounding waters and airspace during May and June 1965*.

* This fact sheet was updated to include the participation of the USS *Carbonero* (SS-337).

Test Name	Big Tom (DTC Test 65-6)
Testing Organization	US Army Deseret Test Center
Test Dates	May – June 1965
Test Location	Oahu, Hawaii, and surrounding waters and airspace
Test Operations	To evaluate the feasibility of a biological attack against an island complex and to evaluate doctrine and tactics for delivery of such an attack.
Participating Services	US Navy, US Marine Corps, US Air Force, Deseret Test Center personnel
Units and Ships Involved	USS *Granville S. Hall* (YAG-40) USS *Carbonero* (SS-337)
Dissemination Procedures	Liquid *Bacillus globigii* was disseminated from an Aero 14B spray tank mounted on a US Navy A-4 aircraft; dry *Bacillus globigii* was disseminated from an A/B Y45-4 spray tank mounted on a US Air Force F-105 aircraft. *Bacillus globigii* was also released from a specially equipped fleet submarine using a submarine-biological-disseminator.
Agents, Simulants, Tracers	*Bacillus globigii* Zinc Cadmium Sulfide
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* Now considered to be *Bacillus subtilis var. niger*, a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the

environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection). (Sources: Tuazon CU, *Other Bacillus Species* (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Zinc cadmium sulfide

This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low. (Sources: National Research Council (National Academies), Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu as of October 1, 2002.)

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Deseret Test Center

Sun Down

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of Sun Down was to evaluate simulant and sarin-filled BLU-19/B23 bomblets in forested and open terrain with snow cover at temperatures between -18°C and -1°C.

Trials were conducted using BLU-19/B23 bomblets filled with methylacetoacetate, tiara, and sarin nerve agent. Bomblets filled with methylacetoacetate were both statically detonated under snow and projected into an open, snow-covered area to determine their depth of detonation in the snow. Bomblets filled with tiara were fired into a spruce forest to determine height of detonation. Five sarin-filled BLU-19/B23 bomblets were statically detonated.

Sun Down was conducted at the Gerstle River test site on Fort Greely, Alaska during February and April 1966.

Test Name	Sun Down (DTC Test 65-11)
Testing Organization	US Army Deseret Test Center
Test Dates	February, April 1966
Test Location	Gerstle River test site, Fort Greely, Alaska
Test Operations	To evaluate the simulant and sarin-filled BLU-19/B23 bomblet in forested and open terrain with snow cover at temperatures between -18°C and -1°C.
Participating Services	US Army, Desert Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Bomblets were statically detonated as well as projected into the open to determine depth and height of detonations.
Agents, Simulants, Tracers	Sarin Nerve Agent Methylacetoacetate Tiara
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of

	Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term health effects. (Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002]Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.) Methylacetoacetate (MAA) This compound was used as a simulant. While acute exposure has been associated with irritation of skin, eyes, respiratory tract, and digestive tract, there is little or no evidence of long-term or late-developing health effects and it is not known to cause cancer in animal testing. (Sources: NLM TOXNET, Methyl acetoacetate 105-45-3, HSDB Human Health Effects and Animal Toxicity Studies, available at http://toxnet.nlm.nih.gov.http://hazard.com/msds/tox/f/q4/q936.html [as of January 28, 2002] and http://www.hbcollege/chem/lab/organic/gilbert3e/resources/studenttools/dl/e_mmsds.pdf) Tiara is a luminescent gelatinous material. No further information is available on this substance.

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Deseret Test Center

Devil Hole, Phase I

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

Devil Hole, Phase I was conducted in temperate aspen and spruce forests to determine area-time-dosage information for Sarin nerve agent-filled artillery munitions (M121A1 155mm shells) and Sarin nerve agent –filled rocket warheads (M55 115 mm warheads.) Particulate simulants were used to study airflow patterns at the intersection of a spruce forest with open terrain. During the preliminary diffusion trials of the test, zinc cadmium sulfide (FP) was used as a particulate substitute for Sarin nerve agent. The fluorescent particles used in this test were of two colors, green and yellow.

Single static and single and multiple dynamic detonations were conducted with the M121A1 artillery shells. Testing of the M55 115mm rocket warhead was limited to single static detonations.

Safety equipment – such as protective clothing, protective masks, barriers, etc. – was used during the test as conditions dictated.

All Devil Hole, Phase I trials were conducted in forested terrain at the Gerstle River test site in the vicinity of Fort Greely, Alaska during the summer of 1965.

Test Name	Devil Hole, Phase I (DTC Test 65-12)
Testing Organization	US Army Deseret Test Center
Test Dates	Summer 1965
Test Location	Gerstle River test site, near Fort Greely, Alaska
Test Operations	To determine area-time-dosage information for Sarin nerve agent-filled artillery munitions and rocket warheads detonated in a temperate forested terrain.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Single static and single and multiple-round detonations of Sarin-filled M121A1 artillery shells and single static detonations of Sarin-filled M55 rocket warheads.
Agents, Simulants, Tracers	Sarin Nerve Agent Zinc Cadmium Sulfide (FP)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An

	Institute of Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term health effects. (Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002]Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.) Zinc cadmium sulfide (ZCdS) This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low. (Sources: National Research Council (National Academies), Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu as of October 1, 2002.)

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Version 3-04-2003

Deseret Test Center
Project SHAD

High Low

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The primary purpose of the High Low test was to assess the vulnerability of ships to an enveloping cloud of toxic G-series nerve agent. The test had two primary objectives. Objective one was to investigate the penetration of a simulant for the nerve agent Sarin (GB) into four types of naval ships operating at sea. Objective two was to estimate the penetration of Sarin into the four types of operational naval ships by evaluating the results of Objective one in conjunction with the Sarin/Sarin-simulant relationship established in Flower Drum, Phase I (DTC Test 64-2). This was done mathematically, no Sarin was used in this test.

Methylacetoacetate was used to simulate Sarin nerve agent. The simulant was disseminated from a modified Model T-45M-2 MARS Portable Gas Turbine located on the bow of the test ship. All personnel (ships' crews and civilian test personnel) were instructed in the use of protective masks, and masks were worn by personnel directly exposed to significant quantities of methylacetoacetate.

The ships which operated in High Low were the USS *Berkely* (DDG-15), the USS *Fechteler* (DD-870), the USS *Okanogan* (APA-220), and the USS *Wexford County* (LST-1168).

High Low tests were conducted in the Pacific Ocean off the coast of San Diego, California, during the period January 11 through February 26, 1965*.

* The 1966 date from the declassified Deseret Test Center final report and originally published in the October 9, 2002, fact sheet for High Low was in error. A review of the ships' logs confirmed that High Low was conducted in 1965.

Test Name	High Low (DTC Test 65-13)
Testing Organization	US Army Deseret Test Center
Test Dates	January 11 – February 26, 1965
Test Location	Testing was conducted in the Pacific Ocean, off the coast of San Diego, California
Test Operations	To assess the vulnerability of ships to an enveloping cloud of toxic G-series nerve agent.
Participating Services	US Navy, Deseret Test Center personnel
Units and Ships Involved	USS *Berkely* (DDG-15) Feb. 8 - 11 & 15, 1965 USS *Fechteler* (DD-87) Feb. 23 - 26, 1965 USS *Okanogan* (APA-220) Jan. 25 - 28, 1965 & Feb. 1 - 2, 1965 USS *Wexford County* (LST-1168) Jan. 11 - 15, 1965 & Jan. 18 - 19, 1965
Dissemination Procedures	Agent cloud was generated by dissemination from a modified Model T-45M-2 MARS Portable Gas Turbine located on the bow of the test ship.
Agents, Simulants, Tracers	Methylacetoacetate
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Methylacetoacetate (MAA) This compound was used as a simulant. While acute exposure has been associated with irritation of skin, eyes, respiratory tract, and digestive tract, there is little or no evidence of long-term or late-developing health effects and it is not known to cause cancer in animal testing.

	(Sources: NLM TOXNET, Methyl acetoacetate 105-45-3, HSDB Human Health Effects and Animal Toxicity Studies, available at http://toxnet.nlm.nih.gov and http://hazard.com/msds/tox/f/q4/q936.html [as of January 28, 2002] and http://www.hbcollege/chem/lab/organic/gilbert3e/resources/studenttools/dl/e_mmsds.pdf

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Deseret Test Center

Elk Hunt, Phase I

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The Elk Hunt, Phase I tests were designed to determine the amount of either standard or modified VX nerve agent picked up on the clothing of personnel traversing various types of contaminated terrain. The tests examined the length of time a barrier is effective in producing casualties. Elk Hunt, Phase I also compared pickup of agent when M23 mines filled with standard and modified VX nerve agent were detonated under water and under ground.

In Elk Hunt, Phase I, standard or modified VX nerve agent was disseminated from M23 mines detonated under ground in three types of terrain – shrubbery, wooded, and ground covered in rye grass – and under water. Personnel, assuming various tactical positions, traversed the contaminated test grids at specified times and the amount of VX picked up on their clothing was measured. Personnel wore complete, impermeable, butyl-rubber outfits and M9A1 masks.

Twenty trials were conducted in the vicinity of Fort Greely, Alaska from July 3 through August 15, 1964.

Test Name	Elk Hunt, Phase I (DTC Test 65-14)
Testing Organization	US Army Deseret Test Center
Test Dates	July 3 – August 15, 1964
Test Location	Fort Greely, Alaska
Test Operations	To determine the amount of either standard or modified VX nerve agent picked up on the clothing of personnel traversing various types of contaminated terrain. To determine the length of time a barrier is effective in producing casualties. To compare pickup of agent when M23 mines filled with standard and modified VX are detonated under ground and under water.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Selected personnel assigned to HHC, 171st Infantry Brigade, 15th Artillery Battalion, 40th Armor Battalion, 4th Battalion, 9th Infantry, 1st Battalion, 47th Infantry, 538th Ordnance Company (Direct Support)
Dissemination Procedures	Standard or modified VX was disseminated from M23 mines detonated under ground and under water.
Agents, Simulants, Tracers	VX Nerve Agent Modified VX Nerve Agent (one percent polyisobutyl-methacrylate added as thickener)
Ancillary Testing	Not identified
Decontamination	Not identified

Potential Health Risks Associated with Agents, Simulants, Tracers	VX Nerve Agent – (Synonyms: Phosphonothioic acid, VX) VX nerve agent is extremely lethal. It is an oily liquid that is clear, odorless, and tasteless. Death usually occurs within 10-15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: constriction of pupils, headaches, runny nose, salivation, tightness in the chest, nausea, vomiting, anxiety, difficulty in thinking, muscle twitches, tremors, and weakness. With severe exposure, symptoms progress to convulsions and respiratory failure. There is little information available regarding the long-term human health effects of exposure to low doses of VX. (Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002]Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997. SBCCOM Online, Edgewood Chemical Biological Center http://in1.apgea.army.mil:80/RDA/msds/vx.htm [as of April 2, 2002] World Health Organization, Department of Sustainable Development & Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002] Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002])

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Deseret Test Center

Elk Hunt, Phase II

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The Elk Hunt, Phase II tests were designed to determine the amount of VX nerve agent picked up on the clothing of personnel traversing breached paths through contaminated areas and M23 minefields; the amount of VX nerve agent deposited on the surface of vehicles traversing VX-contaminated areas or under which an M23 mine had been detonated; the amount of VX nerve agent deposited on the clothing of personnel actively or passively contacting contaminated vehicles; vehicle decontamination by wet steam, high-pressure cold water hosing, and wallow pit; and, the amount of VX vapor rising from VX-contaminated areas.

Thirty-five trials were conducted near Fort Greely, Alaska, between June 7 and July 27, 1965. Five trials were conducted by the Canadian government in conjunction with the Deseret Test Center trials. Chemical Research and Development Laboratories, Edgewood Arsenal, Maryland, performed 11 additional vehicle decontamination trials from October 27 to December 17, 1965.

Personnel who participated in Elk Hunt, Phase II wore complete, impermeable butyl-rubber outfits and M9A1 masks.

Test Name	Elk Hunt, Phase II (DTC Test 65-14)
Testing Organization	US Army Deseret Test Center
Test Dates	June 7 – July 27, 1965 October 27 – December 17, 1965
Test Location	Fort Greely, Alaska Edgewood Arsenal, Maryland Canada
Test Operations	To determine the amount of standard VX nerve agent picked up on the clothing of personnel traversing paths formed by the breaching of minefields and areas contaminated by detonated M23 mines. Tests were made to determine the amount of VX nerve agent picked up by personnel contacting contaminated vehicles.
Participating Services	US Army, Deseret test personnel
Units and Ships Involved	Selected personnel assigned to HHC, 171st Infantry Brigade, 15th Artillery Battalion, 40th Armor Battalion, 4th Battalion, 9th Infantry1st Battalion, 47th Infantry, 538th Ordnance Company (Direct Support)
Dissemination Procedures	Standard VX was disseminated from M23 mines buried with pressure plates flush with the ground.
Agents, Simulants, Tracers	VX Nerve Agent
Ancillary Testing	Not identified
Decontamination	Wet steam, high-pressure cold water hosing, and wallow pit for decontaminating vehicles

Potential Health Risks Associated with Agents, Simulants, Tracers	VX Nerve Agent – Lethal Nerve Agent (Synonyms: Phosphonothioic acid, VX): VX nerve agent is extremely lethal. It is an oily liquid that is clear, odorless, and tasteless. Death usually occurs within 10-15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: miosis (constriction of pupils) and visual effects, headaches and pressure sensation, runny nose and nasal congestion, salivation, tightness in the chest, nausea, vomiting, giddiness, anxiety, difficulty in thinking, difficulty sleeping, nightmares, muscle twitches, tremors, weakness, abdominal cramps, diarrhea, involuntary urination and defecation. With severe exposure symptoms progress to convulsions and respiratory failure. The permissible airborne exposure concentration for VX nerve agent in any 8-hour work shift can be found in Department of the Army Pamphlet 40-8. To date, however, the Occupational Safety and Health Administration has not promulgated a permissible exposure concentration for VX nerve agent. (Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002].SBCCOM Online, Edgewood Chemical Biological Center http://in1.apgea.army.mil:80/RDA/msds/vx.htm [as of April 2, 2002].World Health Organization, Department of Sustainable Development & Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002]. Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve

	Agents GA, GB, GD, and VX, http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002]).

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Deseret Test Center

Pine Ridge

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purposes of Pine Ridge were to ascertain the percentage of BLU-19/B23 and BLU-20/B23 bomblets that function and to determine their dissemination points in or below a jungle canopy; to determine area-time-dosage and diffusion characteristics of agent BZ and Sarin nerve agent when disseminated from single bomblets; and, to estimate the effective area coverage that could be expected if agent BZ and Sarin nerve agent were disseminated from single or multiple SUU-13/A dispenser loads. A secondary objective was to determine any peculiar handling, storage, or safety requirements associated with BLU-19/B23 or BLU-20/B23 bomblets.

BZ is a code name for an ester of benzilic acid. The chemical affects the human mind causing those contaminated to be unable to perform an assignment or have a reduced will to resist for a short period of time. Sarin is a volatile and lethal nerve agent.

Sarin filled BLU-19/B23 and BZ filled BLU-20/B23 bomblets were detonated in test areas in the upper Waiakea Forest Reserve and in the Olaa Forest Preserve, southwest of Hilo, on the island of Hawaii in May and June 1966.

Test Name	Pine Ridge (DTC Test 65-16)
Testing Organization	US Army Deseret Test Center
Test Dates	May – June 1966
Test Location	Island of Hawaii
Test Operations	To evaluate the effectiveness of the BLU-19/B23 Sarin-filled bomblet and the BLU20/B23 agent BZ-filled bomblet in a tropical rain forest.
Participating Services	US Air Force, US Navy, US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Bomblets were projected with an airgun to determine burst height and static detonations were used for area-time-dosage determinations.
Agents, Simulants, Tracers	Ester of benzilic acid (BZ) Sarin Nerve Agent
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Ester of benzilic acid (Agent BZ) This chemical is an incapacitating agent designed to cause stupor, confusion, and hallucinations when inhaled or absorbed through the skin. It is a white powder and may irritate the eyes, skin, and digestive and respiratory tracts, if inhaled or ingested. While some effects may last several days or weeks, long-term or late-developing health effects have not been documented and seem unlikely. (Source: Incapacitating Agents (chap. 5), in US Army Medical Research Institute of Chemical Defense, Medical Management of Chemical

	Casualties Handbook, 3rd edition, 1998; Ketchum JS, Sidell FR Incapacitating Agents (chap. 11), in ed. Zajtchuk R., Textbook of Military Medicine (part 1), Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997. http://www.fas.org/nuke/guide/russia/cbw/jptac008_194001.html [as of September 25, 2002].) Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term health effects. (Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002]Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.)

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Version 05-23-2002

Project Shipboard Hazard and Defense (SHAD)

Fearless Johnny

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The purposes of the Fearless Johnny test were to evaluate the magnitude of interior and exterior contamination from an aerial-delivered chemical weapon system using a simulant for VX nerve agent; demonstrate the effectiveness of the shipboard water washdown system for decontamination and as a protective measure against an aerial spray of VX nerve agent; and, evaluate the operational impact of gross VX nerve agent contamination on a US Navy ship.

VX nerve agent and the VX nerve agent simulant, diethylphthlate, mixed with 0.1 percent of the fluorescent dye DF-504, were used during Fearless Johnny testing.

The USS *George Eastman* (YAG-39) was the test subject vessel for all trials of the test program. The USS *Granville S. Hall* (YAG-40) was assigned to Fearless Johnny as an escort and laboratory support vessel. Two light tugs provided a capability to transfer test samples between the USS *George Eastman* and the support vessels.

The Fearless Johnny trials were conducted at sea, southwest of Honolulu, Hawaii, during August and September 1965. Disseminating aircraft were stationed at an auxiliary airfield on the Island of Kauai.

Test Name	Fearless Johnny (Test 65-17)
Testing Organization	US Army Deseret Test Center
Test Dates	August and September 1965
Test Location	Testing was conducted at sea southwest of Honolulu, Hawaii.
Test Operations	The test subject vessel, the USS *George Eastman* (YAG 39), was challenged by VX nerve agent or its simulant, diethylphthlate, to evaluate the magnitude of exterior and interior contamination levels under three material readiness conditions, demonstrate the effectiveness of the shipboard water washdown system, and evaluate the operational impact of gross VX nerve agent contamination on a US Navy ship.
Participating Services	US Navy, plus Deseret Test Center personnel
Units and Ships Involved	USS *George Eastman* (YAG-39) USS *Granville S. Hall* (YAG-40) Two light tugs (not further identified). VC-1 (previously designated VU-1, Utility Squadron One) the Blue Aiis (Blue Warriors) Squadron provided a Navy A4-B as a disseminator aircraft. Patrol Squadron Six (PATRON SIX), Fleet Air Wing Two, provided two P2V *Neptune* aircraft as airborne command posts and to provide surveillance in the operating area.
Dissemination Procedures	Aerial-delivered aerosolized agent and agent simulant.
Agents, Simulants, Tracers	VX nerve agent Diethylphthlate mixed with 0.1 percent of fluorescent dye DF-504.
Ancillary Testing	Not identified
Decontamination	Water washdown system

Potential Health Risks Associated with Agents, Simulants, Tracers	VX Nerve Agent – Lethal Nerve Agent (Synonyms: Phosphonothioic acid, VX): VX nerve agent is extremely lethal. It is an oily liquid that is clear, odorless, and tasteless. Death usually occurs within 10-15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: miosis (constriction of pupils) and visual effects, headaches and pressure sensation, runny nose and nasal congestion, salivation, tightness in the chest, nausea, vomiting, giddiness, anxiety, difficulty in thinking, difficulty sleeping, nightmares, muscle twitches, tremors, weakness, abdominal cramps, diarrhea, involuntary urination and defecation. With severe exposure symptoms progress to convulsions and respiratory failure. The permissible airborne exposure concentration for VX nerve agent in any 8-hour work shift can be found in Department of the Army Pamphlet 40-8. To date, however, the Occupational Safety and Health Administration has not promulgated a permissible exposure concentration for VX nerve agent. (Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002]. *SBCCOM Online*, Edgewood Chemical Biological Center http://in1.apgea.army.mil:80/RDA/msds/vx.htm [as of April 2, 2002]. World Health Organization, Department of Sustainable Development & Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002]. Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX, http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002]). Diethylphthlate (Synonyms: diethyl ester 2, Benzenedicarboxylic acid). Short-term exposure to diethylphthlate vapors can irritate the nose and throat. If splashed in the eyes, diethylphthlate can cause considerable eye pain but no, or slight, reversible damage. The Environmental Protection Agency places this substance in category D - not classifiable as a human carcinogen.

	Diethylphthlate is only very slowly absorbed through the skin; however, ingestion in high concentrations can cause gastrointestinal irritation, or hypotension. Diethylphthlate has been used routinely as an insect repellent since World War II. It is also used in cosmetics and aspirin. (Sources: New Jersey Department of Health and Senior Services, http://www.state.nj.us/health/eoh/rtkweb/0707.pdf [as of January 25, 2002]. National Institute for Occupational Safety and Health [NISOH] *International Chemical Safety Cards* http://www.cdc.gov/niosh/ipcsneng/neng0258.html [as of January 25, 2002]. Agency for Toxic Substances and Disease Registry, National Toxicology Program, http://ntp-server.niehs.nih.gov/htdocs/Chem_H&S/NTP_Chem8/Radian84-66-2.html [as of January 25, 2002].

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Deseret Test Center

Devil Hole, Phase II

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

Devil Hole, Phase II was conducted in temperate aspen and spruce forested terrain to provide weapons effects information for artillery delivered VX nerve agent-filled shells. The munitions used were M121A1 (155m) and M426 (8-inch) artillery shells filled with VX nerve agent.

Munitions were statically detonated and M-109 self-propelled howitzers were also used to dynamically fire shells on the target. Manikins dressed in undyed cotton overgarments were used to estimate direct contamination of standing personnel in the area of a munition detonation. A three-quarter ton truck and an eight-by-ten foot tent wall were used to measure deposition on equipment.

Devil Hole, Phase II trials were conducted at the Gerstle River test site near Fort Greely, Alaska, from July through September 1966.

Test Name	Devil Hole, Phase II (DTC Test 66-1)
Testing Organization	US Army Deseret Test Center
Test Dates	July – September 1966
Test Location	Gerstle River test site, near Fort Greely, Alaska
Test Operations	To provide weapons effects information for artillery delivered VX nerve agent-filled shells detonated in temperate, forested terrain.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Munitions were statically detonated and M-109 self-propelled howitzers were used to dynamically fire shells on the target.
Agents, Simulants, Tracers	VX Nerve Agent
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	VX Nerve Agent – (Synonyms: Phosphonothioic acid, VX) VX nerve agent is extremely lethal. It is an oily liquid that is clear, odorless, and tasteless. Death usually occurs within 10-15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: constriction of pupils, headaches, runny nose, salivation, tightness in the chest, nausea, vomiting, anxiety, difficulty in thinking, muscle twitches, tremors, and weakness. With severe exposure, symptoms progress to convulsions and respiratory failure. There is little information available regard-

	ing the long-term human health effects of exposure to low doses of VX. (Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002]Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997. SBCCOM Online, Edgewood Chemical Biological Center http://in1.apgea.army.mil:80/RDA/msds/vx.htm [as of April 2, 2002]World Health Organization, Department of Sustainable Development & Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002] Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002]) [as of February 5, 2002])

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Deseret Test Center

Red Oak, Phase I

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purposes of Red Oak, Phase I were to determine the height-of-burst distributions of the 121A1 (155mm) chemical projectiles and the M55 (115mm) rocket warheads when fired into a jungle environment, and to determine the effects of fragmentation from bursting chemical munitions.

Red Oak, Phase I was conducted on the Island of Hawaii and in the Panama Canal Zone. Tests involving the M55 rocket warhead and the dissemination of Sarin nerve agent from the M121A1 projectile were conducted in the upper Waiakea Forest Reserve on the Island of Hawaii, southwest of Hilo.

Tests to determine fragmentation effects of artillery projectiles were conducted on the Pina Ridge near the Fort Sherman Military Reservation, Panama Canal Zone. These tests were not chemical weapons tests. Instead they used either standard artillery rounds or projectiles filled with an unspecified simulant.

Test Name	Red Oak, Phase I (DTC Test 66-2)
Testing Organization	US Army Deseret Test Center
Test Dates	April – May 1967
Test Location	Upper Waiakea Forest Reserve, Island of Hawaii Pina Ridge, near Fort Sherman Military Reservation, Panama Canal Zone
Test Operations	To evaluate the effectiveness of Sarin filled 155mm artillery projectiles and 115mm rocket warheads in a tropical jungle environment.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Munitions were statically detonated.
Agents	Sarin Nerve Agent (Hawaii)
Simulants and Tracers	Unspecified chemical agent simulant (Panama Canal Zone)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An

	Institute of Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term health effects. (Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002] Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.)

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Deseret Test Center

Swamp Oak

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The objective of Swamp Oak was to determine area-time-dosage relationships as a function of burst height and agent diffusion characteristics, within subarctic forested areas, for Sarin nerve agent-filled artillery munitions in temperatures ranging from -1°C to -18°C.

Sarin nerve agent-filled M121A1 (155mm) artillery shells were detonated statically and singly in a coniferous forest under winter conditions. To simulate an air burst, the shell was suspended using a cable, a hoist, and a special strap-steel sling.

Swamp Oak trials were conducted during March and April 1966 at the Gerstle River test site near Fort Greely, Alaska.

Test Name	Swamp Oak (DTC Test 66-3)
Testing Organization	US Army Deseret Test Center
Test Dates	March - April 1966
Test Location	Gerstle River test site, near Fort Greely, Alaska
Test Operations	To determine time-area-dosage relationships as a function of burst height and agent diffusion characteristics, within subarctic forested areas, for Sarin nerve agent-filled artillery munitions in temperatures ranging from -1°C to -18°C.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Sarin nerve agent-filled M121A1 (155mm) artillery shells were statically and singly detonated in a coniferous forest under winter conditions.
Agents, Simulants, Tracers	Sarin Nerve Agent
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of Medicine committee concluded that there was insufficient evidence for or against an association

	between low-level sarin exposure and long-term health effects. (Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002] Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.)

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Deseret Test Center

Green Mist

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The primary purpose of Green Mist was to estimate the effective dosage area coverage that could be expected if sarin nerve agent-filled M139 bomblets were disseminated from four different weapons systems over a rain forest canopy.

Trials were conducted using sarin nerve agent and the simulant methylacetoacetate.

Green Mist was conducted on the island of Hawaii during the period of March 25 through April 24, 1967.

Test Name	Green Mist (DTC Test 66-4)
Testing Organization	US Army Deseret Test Center
Test Dates	March 25 – April 24, 1967
Test Location	Island of Hawaii
Test Operations	To determine the average dosage in a mountain rain forest of four chemical weapon systems employing the M139 sarin nerve agent bomblet.
Participating Services	Deseret Test Center
Units and Ships Involved	Not identified
Dissemination Procedures	M139 sarin nerve agent-filled bomblets were statically detonated at several heights below the canopy.
Agents, Simulants, Tracers	Sarin Nerve Agent Methylacetoacetate
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of Medicine committee concluded that there was insufficient evidence for or against an association

between low-level sarin exposure and long-term health effects.

(Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002]Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.)

Methylacetoacetate (MAA)
This compound was used as a simulant. While acute exposure has been associated with irritation of skin, eyes, respiratory tract, and digestive tract, there is little or no evidence of long-term or late-developing health effects and it is not known to cause cancer in animal testing.

(Sources: NLM TOXNET, Methylacetoacetate 105-45-3, HSDB Human Health Effects and Animal Toxicity Studies, available at http://toxnet.nlm.nih.gov.http://hazard.com/msds/tox/f/q4/q936.html [as of January 28, 2002] and http://www.hbcollege/chem/lab/organic/gilbert3e/resources/studenttools/dl/e_mmsds.pdf)

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Version 05-23-2002

Project Shipboard Hazard and Defense (SHAD)

Purple Sage

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The primary purpose of the Purple Sage test was to evaluate the effectiveness of the experimental Shipboard Toxicological Operational Protection System (STOPS) against environmental attack with a gaseous chemical warfare agent under operational situations. An additional objective was to evaluate the effect that the wearing of protective masks (MK5 or M17) for a four-hour period had on the operational efficiency of a ship's crew.

The chemical warfare test agent was methylacetoacetate, a sarin nerve agent simulant. The STOPS-equipped destroyer, USS *Herbert J. Thomas* (DD-833), was enveloped by a test agent cloud generated by release of methylacetoacetate through a turbine disseminator located on the bow of the ship.

Purple Sage tests were conducted in an operational area of the Pacific Ocean, off San Diego, California, during the period January 5 through February 3, 1966.

Test Name	Purple Sage (Test 66-5)
Testing Organization	US Army Deseret Test Center
Test Dates	January 5 - February 3, 1966
Test Location	Testing was conducted in the Pacific Ocean, off San Diego, California.
Test Operations	To test the Shipboard Toxicological Operational Protective System (STOPS), a test agent was released through a turbine disseminator located on the bow of the ship.
Participating Services	US Navy, plus Deseret Test Center personnel
Units and Ships Involved	USS *Herbert J. Thomas* (DD-833)
Dissemination Procedures	Test agent was released through a turbine disseminator.
Agents, Simulants, Tracers	Methylacetoacetate
Ancillary Testing	MK5 and M17 protective masks
Decontamination	Not identified
Potential Health Risks, Associated with Agents, Simulants, Tracers	Methylacetoacetate (MAA) (Synonyms: methyl acetoacetate, acetoacetic acid, methyl ester) Potential health effects consist of low to moderate eye, skin, and respiratory tract irritation and possible gastrointestinal irritation with nausea, vomiting, and diarrhea. EPA does not consider methlyacetoacetate to be a hazardous material. It is not a known carcinogen. (Sources: http://hazard.com/msds/tox/f/q4/q936.html [as of January 28, 2002] and http://www.hbcollege/chem/lab/organic/gilbert3e/resources/studenttools/dl/e_mmsds.pdf

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Version 01-17-2002

Project Shipboard Hazard and Defense (SHAD)

Scarlet Sage

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The primary purpose of the Scarlet Sage test was to evaluate the effectiveness of the experimental Shipboard Toxicological Operational Protection System (STOPS) against environmental attack of a BW tracer under operational situations.

The biological tracer was Bacillus subtilis var. niger (often referred to as Bacillus globigii [BG]). The STOPS destroyer, USS *Herbert J. Thomas* (DD-833), was challenged with aerosols of BG released from a continuous point source approximately 500 meters upwind of the ship.

Scarlet Sage tests were conducted in an operational area of the Pacific Ocean, off San Diego, California during the period February 9 through March 4, 1966.

Test Name	Scarlet Sage (Test 66-6)
Testing Organization	US Army Deseret Test Center
Test Dates	February 9 – March 4, 1966
Test Location	Testing was conducted in the Pacific Ocean, off San Diego, California.
Test Operations	To test the Shipboard Toxicological Operational Protective System (STOPS), a BW tracer was disseminated upwind of the ship.
Participating Services	Navy, plus Deseret personnel
Units and Ships Involved	USS *Herbert J. Thomas* (DD-833)
Dissemination Procedures	An aerosolized slurry of Bacillus subtilis var. niger (BG) was released from a point source located approximately 500 meters upwind of the target vessel.
Agents, Simulants, Tracers	Bacillus subtilis var. niger (BG).
Ancillary Testing	Not identified.
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Bacillus subtilis var. niger (Bacillus globigii [BG]) The American Type Culture Center characterizes Bacillus subtilis var. niger as a BioSafety Level-1 (BSL-1) bacterium. The Centers for Disease Control and Prevention define BSL-1 as suitable for work involving well-characterized agents not known to consistently cause disease in healthy adult humans. (Sources: American Type Culture Collection data sheet, http://phage.atcc.org [as of January 11, 2002] and *Biosafety in Microbiological and Biomedical Laboratories*, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention and National Institutes of Health, 4th ed., p. 17, April 1999, U.S. Government Printing Office, Washington)

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Deseret Test Center

West Side, Phase II

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of West Side, Phase II was to evaluate the area coverage capabilities of the A/B 45-Y-4/F-105 powdered agent dissemination system as used operationally over a northern open plains region during cold weather. Twelve trials were conducted in which both *Bacillus globigii* and zinc cadmium sulfide (FP) were simultaneously disseminated, each from separate, wing-mounted Y-4 disseminators on an F-105 aircraft. A second release of FP of a different fluorescent color was made by a contractor aircraft immediately after the dissemination run by the F-105. The contractor aircraft, a JHC-47, and EW-2 disseminator released FP both above and below the inversion top to measure its influence on aerosol travel.

The Canadian government permitted three flight paths for the dissemination of tracers. These flight paths and the corresponding trajectories of aerosol travel were selected to preclude travel of simulants and tracers over heavily populated areas, or over the inhabited areas of Suffield Experimental Station.

WEST SIDE, PHASE II

2-2-2-2

West Side, Phase II was conducted in the Great Plains Region of central Canada, with the test area extending north and east from the Suffield Experimental Station, southern Alberta Province, and into southwestern Saskatchewan. The testing period extended from January 5 through March 7, 1965.

Test Name	West Side, Phase II (DTC Test 66-8)
Testing Organization	US Army Deseret Test Center
Test Dates	January 5 – March 7, 1965
Test Location	Great Plains Region of Central Canada, north and east of the Suffield Experimental Station, southern Alberta Province, and into southwestern Saskatchewan
Test Operations	To evaluate the area coverage capability of an airborne dry agent dissemination system when operated in a frigid environment.
Participating Services	US Air Force, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Simulant and tracer material sprayed from an AB 45-Y4 powdered agent disseminator mounted on an F-105 aircraft. Tracer material was also disseminated above and below the inversion layer using an EW-2 disseminator mounted on a contractor-operated JHC-47 aircraft.
Agents, Simulants, Tracers	*Bacillus globigii* Zinc Cadmium Sulfide (FP)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger*, a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of

	the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection). (Sources: Tuazon CU, Other Bacillus Species (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, Bacillus subtilis Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.) Zinc cadmium sulfide (ZCdS) This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low. (Sources: National Research Council (National Academies), Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc

	Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu as of October 1, 2002.)

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Deseret Test Center

Pin Point

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purposes of Pin Point were to evaluate the riot-control-agent CS-dispensing, man- portable E8 launcher and the aerially-delivered CBU-19/A and CBU-30/A munitions for area-coverage-time-dosage relationships in a tropical jungle environment. The reactions to CS of unmasked, volunteer personnel operating in the impact area and the persistency of the agent were also evaluated.

Ortho-chlorobenzylidene malonotrile (CS), a white crystalline powder riot-control agent, was used for the Pin Point tests. CS was dispersed by a counterinsurgency-type aircraft (A-1E/Skyraider) using CBU-30/A and CBU-19/A munitions as well as by using an E8 man portable launcher.

While the United States does not classify CS as a chemical warfare agent, Deseret Test Center managed Pin Point as a matter of convenience. Testing CS delivery methods was not part of a chemical-biological warfare agent assessment.

Pin Point trials were conducted in 1966 in a tropical jungle type environment.

Test Name	Pin Point (Test 66-10)
Testing Organization	US Army Deseret Test Center
Test Dates	1966 (specific dates not identified in the final report.)
Test Location	Tropical jungle environment (specific location not identified in final report.)
Test Operations	The riot-control-agent CS-dispensing, man portable E8 launcher, and the aerially delivered CBU-19/A and CBU-30/A munitions were operationally evaluated for area-coverage-time-dosage relationships in a tropical jungle environment. Reactions of unmasked, volunteer personnel operating in the impact area were evaluated as well as the persistency of the agent.
Participating Services	Deseret Test Center personnel, US Army, US Air Force, US Marine Corps
Units and Ships Involved	Counterinsurgency type aircraft (A 1E/Skyraider)
Dissemination Procedures	CS-filled submunitions were released from single and double dynamic drops of the CBU-19/A munition, CBU-30/A munition and from the firing of the E8 launcher.
Agents	CS Riot-Control Agent
Simulants and Tracers	Not identified
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	CS Riot – Control Agent CS is one of several chemicals commonly called "Tear Gas." CS is a white, crystalline powder and is dispersed into the air as either an aerosol or powder.

	The chemical name for CS is ortho-chlorobenzylidene malononitrile. It is chemically identical to CS2 but differs in its physical characteristics. This chemical is an incapacitating/riot-control agent that acts as a contact irritant on the exposed body surfaces (eyes and skin), and on the respiratory tract. Exposure to CS causes burning, irritation, tearing and pain in the eyes. Airway symptoms include burning, sneezing, cough, shortness of breath and increased secretions, such as runny nose and increased salivation. High concentrations of CS can cause blistering of the skin. With commonly used concentrations, these effects are short-term and the potential for long-term health consequences is low. (Sources: Riot-Control Agents (chap. 6), in US Army Medical Research Institute of Chemical Defense, Medical Management of Chemical Casualties Handbook, 3rd edition, 1998; Sidell FR, Riot Control Agents (chap. 12), in Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997, p. 310-6. *http://www.metrokc.gov/health/hazard/riotcontrol.htm#cs* [as of September 26, 2002] and Cornell University, *http://msds.pdc.cornell.edu/msds/siri/files/chl/chlfz.html* [as of August 26, 2002]).

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Deseret Test Center
Project SHAD

Half Note

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The purpose of the Half Note test was to determine biological decay rates of vegetative nonpathogens in a marine environment and to compare the field decay rates with chamber decay rates when conducted under similar conditions. Trials included the release of *Escherichia coli* or *Serratia marcescens* with *Bacillus globigii*.

In each trial, a slurry of *Bacillus globigii* and one of the two other organisms were released from Aero 14B spray tanks, wing-mounted on an A-4 aircraft. During each trial, the USS *George Eastman* (YAG-39) and five Army light tugs would traverse upwind attempting to remain in the aerosol cloud for several hours. Additional trials were conducted using a Navy fleet submarine, the USS *Carbonero* (SS-337). Using a submarine-biological-disseminator, the submarine released *Bacillus globigii* only. In addition, the USS *Granville S. Hall* (YAG-40) took complete surface observations, every half-hour during the trials.

Calcofluor, a fluorescent tracer, was used as a tool for determining cloud arrival and departure. For this test, a contractor released and sampled a stable inorganic tracer, zinc cadmium sulfide (FP), type 3206 green.

Half Note tests were conducted in the Pacific Ocean off the coast of Hawaii, approximately 80 nautical miles south-southwest of Oahu from August 18 - September 30, 1966.*

* This fact sheet was updated to include the participation of the USS *Carbonero* (SS-337).

Test Name	Half Note (DTC Test 66-13)
Testing Organization	US Army Deseret Test Center
Test Dates	August 18 – September 30 1966
Test Location	In the Pacific Ocean off the coast of Hawaii, approximately 80 nautical miles south-southwest of Oahu.
Test Operations	To determine biological decay rates of *Escherichia coli* and *Serratia marcescens* in a marine environment.
Participating Services	US Navy, Deseret Test Center personnel
Units and Ships Involved	USS *George Eastman* (YAG-39) USS *Granville S. Hall* (YAG-40) USS *Carbonero* (SS 337) Army light tugs 2080, 2081, 2085, 2086, and 2087, all staffed by USN personnel
Dissemination Procedures	Sprayed from A-4 aircraft equipped with Aero 14B spray tanks and released from a fleet submarine specially equipped with a submarine-biological-disseminator.
Agents, Simulants, Tracers	*Bacillus globigii* *Serratia marcescens* *Escherichia coli* Calcofluor (fluorescent brightner 28) Zinc cadmium sulfide (FP)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* Now considered to be *Bacillus subtilis var. niger,* a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to

healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection).(Sources: Tuazon CU, *Other Bacillus Species* (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Serratia marcescens

This bacterial species can cause acute infections of the urinary tract, lung, bloodstream, and other body sites. These infections commonly occur in individuals whose health has already been compromised, and often in patients who are already hospitalized. Long-term or late-developing health effects would be very unlikely.(Source: Eisenstein, Barry I., Zaleznik, Dori F., Enterobacteriaceae (chap. 206), in *Principles and Practice of Infectious Diseases*, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2303.)

Escherichia coli, or *E. Coli*

This bacterial species is a common inhabitant of the digestive tract but can also cause acute infection, especially when it gains access to other body sites, like the urinary tract, lung, and bloodstream. Long-term or late-developing health effects of E. coli infection would be unlikely. (Source: Eisenstein, Barry I., Zaleznik, Dori F., Enterobacteriaceae (chap. 206), in

Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2299-301.)

Calcofluor (fluorescent brightener 28, Calcofluor White ST)

Used as a fluorescent tracer with *Bacillus globigii*. Chemical formula is $C_{40}H_{42}N_{12}Na_2O_{10}S_2$. This chemical has been used as a medical laboratory stain and as a whitening agent in detergents. It can cause eye irritation in animal testing, but there is limited evidence for or against human health effects. (Source: http://hazard.com/msds/tox/f/q127/q679.html [as of April 30, 2002]NLM TOXNET, Cellufluor 4193-55-9, available at http://toxnet.nlm.nih.gov)

Zinc cadmium sulfide

This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low.(Sources: National Research Council (National Academies), Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu as of October 1, 2002.)

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Deseret Test Center

Dew Point

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of Dew Point was to determine the effectiveness of Sarin nerve agent-filled BLU-19/B23 bomblets ejected from an SUU-13/A dispenser, and M139 bomblets dropped from a SADEYE dispenser in a temperate summer forest environment

The test area was situated in a heavy stand of deciduous aspen trees. A test grid was established in the aspen forest. Sarin nerve agent-filled M139 bomblets were used in Dew Point trials. The bomblets were individually statically detonated.

The test was conducted from June through July 1967 at the Gerstle River test site, near Fort Greely, Alaska.

Test Name	Dew Point (DTC Test 67-2)
Testing Organization	US Army Deseret Test Center
Test Dates	June – July 1967
Test Location	Gerstle River test site, near Fort Greely, Alaska
Test Operations	To determine the effectiveness of Sarin nerve agent-filled BLU-19/B23 bomblets ejected from an SUU-13/A dispenser, and M139 bomblets dropped from a SADEYE dispenser in a temperate summer forest environment.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Single bomblets were statically detonated.
Agents, Simulants, Tracers	Sarin Nerve Agent
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term

	health effects. (Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002] Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.)

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Blue Tango

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purposes of the Blue Tango test were to determine the decay rates of *Serratia marcescens* and *Escherichia coli* aerosols when released at ground level into a tropical rain forest environment, and when released from above the canopy of a tropical rain forest. The test was also designed to evaluate environmental factors affecting decay of the *Serratia marcescens* and *Escherichia coli* microorganisms.

In addition to *Serratia marcescens* and *Escherichia coli*, each trial also consisted of the biological simulant *Bacillus globigii* and fluorescent particles (FP) for tracking biological materials.

Blue Tango consisted of 20 trials with aerosol release below the canopy and 20 trials with aerosol release above the canopy. Each group of 20 trials comprised 10 trials with *Bacillus globigii* and *Serratia marcescens* and 10 trials with *Bacillus globigii* and *Escherichia coli*.

Dissemination in all trials was from E2-type nozzles with suitable pressurizing equipment. Above canopy releases were made from a 32-meter tower using equipment and procedures similar to ground-release trials.

Blue Tango was conducted in a rain forest located on the south side of Stainback Road, approximately four miles east of Kulani Honor Camp on the Island of Hawaii between January 18 and March 1, 1968.

Test Name	Blue Tango (DTC Test 67-6)
Testing Organization	US Army Deseret Test Center
Test Dates	January 18 – March 1, 1968
Test Location	Island of Hawaii
Test Operations	To determine the decay rates of *Serratia marcescens* and *Escherichia coli* aerosols when released at ground level into a tropical rain forest environment, and when released from above the canopy of a tropical rain forest. To evaluate environmental factors affecting the decay of *Serratia marcescens* and *Escherichia coli.*
Participating Services	US Army, US Air Force, and Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Dissemination in all trials was from E2-type nozzles with suitable pressurizing equipment. Above canopy releases were made from a 32-meter tower using equipment and procedures similar to ground-release trials..
Agents, Simulants, Tracers	*Bacillus globigii* *Serratia marcescens* *Escherichia coli* Fluorescent particles (FP)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* Now considered to be *Bacillus subtilis var. niger,* a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis*

and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection).(Sources: Tuazon CU, *Other Bacillus Species* (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Serratia marcescens

This bacterial species can cause acute infections of the urinary tract, lung, bloodstream, and other body sites. These infections commonly occur in individuals whose health has already been compromised, and often in patients who are already hospitalized. Long-term or late-developing health effects would be very unlikely. (Source: Eisenstein, Barry I., Zaleznik, Dori F., Enterobacteriaceae (chap. 206), in *Principles and Practice of Infectious Diseases*, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2303.)

Escherichia coli, or *E. Coli*

This bacterial species is a common inhabitant of the digestive tract but can also cause acute infection, especially when it gains access to other body sites, like the urinary tract, lung, and bloodstream. Long-term or late-developing health effects of E. coli infection would be unlikely. (Source: Eisenstein, Barry I., Zaleznik, Dori F., Enterobacteriaceae (chap. 206), in *Principles and Practice of Infectious Diseases*, 5th edition

	(vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2299-301.) Fluorescent particles (FP) This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low. (Sources: National Research Council [National Academies], Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu [as of October 1, 2002]).

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Red Cloud

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The main purpose of Red Cloud was to obtain biological decay rate and animal infectivity data on aerosols of *Francisella tularensis* (wet and dry forms) disseminated in a frigid field environment. Measurements of the infectivity to monkeys were made at extremely low ambient temperatures; determinations were also made for biological decay rates of *Francisella tularensis* (wet and dry), *Serratia marcesens* and *Escherichia coli.*

M143 bomblets were projected from a tower-mounted gun into a wintertime spruce forest simulating an operational drop. E26 and M32 dissemination devices were also used to disseminate aerosols for biological decay rate measurements. The liquid biologicals *Francisella tularensis*, *Serratia marcescens*, and *Escherichia coli* were released from E26 disseminators as an intermix with *Bacillus globigii.* Sampling crews were stationed in pressurized safety citadels at predetermined intervals, downwind of the agent release line to facilitate immediate assay of samples in an area free of background contamination.

Prior to conducting Red Cloud in the Tanana Valley, the Deseret Test Center had conducted a Special Study, Alaska, which was a preliminary field effort with vegetative, nonpathogenic bacteria to prepare for future tests with pathogenic vegetative bacteria at the Alaskan site. A DTC advisory committee concurred in the proposed method of pathogen testing, subject to certain restrictions on agent dissemination. These restrictions limited the amount of agent dissemination for each field trial to preclude possible travel of agent pathogens over inhabited areas of the valley.

Testing began in late November 1966 and was completed in mid-February 1967. All of the field trials were conducted in the Tanana Valley of central Alaska, near Fort Greely.

Test Name	Red Cloud (DTC Test 67-7)
Testing Organization	US Army Deseret Test Center
Test Dates	November 1966 – February 1967
Test Location	Tanana Valley of central Alaska, near Fort Greely
Test Operations	To obtain biological decay rates on *Francisella tularensis* (wet and dry form), *Escherichia coli*, and *Serratia marcesens* in a sub-zero overland environment.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	M143 bomblets were projected from a tower-mounted gun into a wintertime spruce forest simulating an operational drop. E26 and M32 dissemination devices were also used to disseminate aerosols for biological decay rate measurements.
Agents, Simulants, Tracers	*Bacillus globigii* *Serratia marcescens* *Escherichia coli* *Francisella tularensis* (wet) (TT) *Francisella tularensis* (dry) (ZZ)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii (BG)* Now considered to be *Bacillus subtilis var. niger*, a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease.

They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection).

(Sources: Tuazon CU, Other Bacillus Species (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, Bacillus subtilis Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Serratia marcescens (SM)
This bacterial species can cause acute infections of the urinary tract, lung, bloodstream, and other body sites. These infections commonly occur in individuals whose health has already been compromised, and often in patients who are already hospitalized. Long-term or late-developing health effects would be very unlikely.

(Source: Eisenstein, Barry I., Zaleznik, Dori F., Enterobacteriaceae (chap. 206), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2303.)

Escherichia coli, or *E. Coli* (EC)
This bacterial species is a common inhabitant of the digestive tract but can also cause acute infection, especially when it gains access to other body sites, like the urinary tract, lung, and bloodstream. Long-

	term or late-developing health effects of *E. coli* infection would be unlikely. (Source: Eisenstein, Barry I., Zaleznik, Dori F., Enterobacteriaceae (chap. 206), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2299-301.) *Francisella tularensis* (TT and ZZ) Formerly identified as *Pasteurella tularensis*, this bacterial species can cause acute infection of the lung, bloodstream, and other body sites (tularemia), and is considered a potential biological warfare agent. While complications of the acute infection may be serious, even life threatening, long-term or late-developing health effects would be very unlikely. (Sources: Cross, J. Thomas Jr., Penn, Robert L., Francisella tularensis (Tularemia) (chap. 216), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2393-2402; and Dennis DT, Inglesby TV, Henderson DA, et al. Tularemia as a biological weapon; medical and public health management. JAMA 2001;285(21):2763-73.)

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Deseret Test Center

Watch Dog

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The main purpose of Watch Dog was to obtain viability decay rates of *Francisella tularensis* (wet and dry forms), *Serratia marcesens*, and *Escherichia coli.* and stabilized *Francisella tularensis* animal infectivity data in a summer temperate environment. Six trials were conducted to measure the infectivity to monkeys in temperate environments using wet *Francisella tularensis*. The remaining trials determined biological decay rates for *Francisella tularensis* (wet and dry), *Serratia marcesens* and *Escherichia coli* in an environment considered analogous to the temperate humid areas of the northern hemisphere during the summer.

All of the Watch Dog trials were conducted in the area of Delta Creek in central Alaska near Fort Greely. The test was conducted in the summer of 1967.

Test Name	Watch Dog (DTC Test 67-8)
Testing Organization	US Army Deseret Test Center
Test Dates	Summer 1967
Test Location	Delta Creek area of central Alaska, near Fort Greely
Test Operations	To obtain biological decay rates on *Francisella tularensis* (wet and dry form), *Escherichia coli*, and *Serratia marcesens* in a summer temperate environment.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Not Identified
Agents, Simulants, Tracers	*Bacillus globigii* *Serratia marcescens* *Escherichia coli* *Francisella tularensis* (wet) (TT) *Francisella tularensis* (dry) (ZZ)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Bacillus globigii (BG) Now considered to be *Bacillus subtilis var. niger*, a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-

	developing health effects would be very unlikely (except perhaps as a complication of the acute infection). (Sources: Tuazon CU, Other Bacillus Species (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, Bacillus subtilis Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.) *Serratia marcescens* (SM) This bacterial species can cause acute infections of the urinary tract, lung, bloodstream, and other body sites. These infections commonly occur in individuals whose health has already been compromised, and often in patients who are already hospitalized. Long-term or late-developing health effects would be very unlikely. (Source: Eisenstein, Barry I., Zaleznik, Dori F., Enterobacteriaceae (chap. 206), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2303.) *Escherichia coli*, or *E. Coli* (EC) This bacterial species is a common inhabitant of the digestive tract but can also cause acute infection, especially when it gains access to other body sites, like the urinary tract, lung, and bloodstream. Long-term or late-developing health effects of E. coli infection would be unlikely.

	(Source: Eisenstein, Barry I., Zaleznik, Dori F., Enterobacteriaceae (chap. 206), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2299-301.) *Francisella tularensis* (TT and ZZ) Formerly identified as Pasteurella tularensis, this bacterial species can cause acute infection of the lung, bloodstream, and other body sites (tularemia), and is considered a potential biological warfare agent. While complications of the acute infection may be serious, even life threatening, long-term or late-developing health effects would be very unlikely. (Sources: Cross, J. Thomas Jr., Penn, Robert L., Francisella tularensis (Tularemia) (chap. 216), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2393-2402; and Dennis DT, Inglesby TV, Henderson DA, et al. Tularemia as a biological weapon; medical and public health management. JAMA 2001;285(21):2763-73.)

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Deseret Test Center

Rapid Tan I, II, III

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

Deseret Test Center Test 68-13 (Rapid Tan I, II, III) was a joint U.S., U.K., and Canadian program designed to investigate the extent and duration of hazard following a Tabun, Soman or V nerve agent attack. Phases I and III trials involving agents Tabun, Sarin, Soman and VX spray in both open grassland and wooded terrain were conducted at the Chemical Defence Establishment, Porton Down, England. Both Tabun and Soman spray and munition (Soman-filled) trials (Phase II) were conducted at the Suffield Defence Research Establishment, Ralston, Canada.

The purpose of the Rapid Tan I, II, III tests was to obtain rate-of-vapor return data for agents Tabun and Soman when sprayed on different terrain types in a summer (temperate) environment. Sarin and VX trials were also conducted to strengthen confidence in the Tabun and Soman data by allowing comparisons of data from Sarin and VX munition tests conducted in the same environment.

The weapons systems germane to this test were explosive munitions (Soman-filled), aircraft spray, rain-type munitions (using both Tabun and Soman), and massive bombs (Tabun- and Soman-filled).

DTC Test 68-13 trials were conducted during three time periods: July – August 1967; May – June 1968; and, August – September 1968.

Test Name	Rapid Tan I, II, III (DTC Test 68-13)
Testing Organization	US Army Deseret Test Center
Test Dates	Jul – Aug 1967; May – Jun 1968; Aug – Sep 1968
Test Location	Chemical Defence Establishment, Porton Down, England (Phases I and III) Suffield Defence Research Establishment, Ralston, Canada (Phase II)
Test Operations	To determine rate of evaporation of Tabun, Sarin, Soman, and VX as a function of contamination density, drop size, and terrain cover under a variety of meteorological conditions in a temperate environment.
Participating Services	Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Agent was disseminated using 155mm Howitzer shells (Soman-filled) and a crop sprayer to simulate agent dissemination from aircraft, rain type munitions, and massive bomb dissemination.
Agents, Simulants, Tracers	Sarin Nerve Agent Soman Nerve Agent Tabun Nerve Agent VX Nerve Agent
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery

	eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term health effects. (Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002] Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.) Soman Nerve Agent (GD) Soman is a colorless liquid, which gives off an odor of rotting fruit when vaporizing. The vapor is colorless. Soman is a persistent agent that can easily remain in a particular area for a day or longer, depending on the atmospheric conditions. Acute health effects associated with exposure to soman include a runny nose, tightness in the chest, constriction of the pupils, difficulty in breathing, coma, and death. There is little information available regarding the long-term human health effects of exposure to soman. (Source: http://www.sbccom.army.mil/services/edu/soman.htm Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997.)

	Tabun Nerve Agent (GA) Tabun is an amber, non-persistent liquid, which gives off little odor when vaporizing. The vapor is colorless. When exposed to tabun, the symptoms a victim will experience include a runny nose, tightness in the chest, constriction of the pupils, difficulty breathing, and nausea. Ultimately the victim will become comatose and will suffocate as a consequence of convulsive spasms. Tabun is mainly absorbed through the skin; however, vapors can also be hazardous. If a person does not receive an immediately lethal dose, death will occur after approximately 20 minutes. Those receiving a less than lethal dose who do not receive immediate medical care may suffer permanent neurological damage. There is little information available regarding the long-term human health effects of exposure to low doses of tabun. (Source: http://www.sbccom.army.mil/services/edu/tabun.htm Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997. VX Nerve Agent – (Synonyms: Phosphonothioic acid, VX) VX nerve agent is extremely lethal. It is an oily liquid that is clear, odorless, and tasteless. Death usually occurs within 10-15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: constriction of pupils, headaches, runny nose, salivation, tightness in the chest, nausea, vomiting, anxiety, difficulty in thinking, muscle twitches, tremors, and weakness. With severe exposure, symptoms

	progress to convulsions and respiratory failure. There is little information available regarding the long-term human health effects of exposure to low doses of VX. (Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002]Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997. SBCCOM Online, Edgewood Chemical Biological Center http://in1.apgea.army.mil:80/RDA/msds/vx.htm [as of April 2, 2002] World Health Organization, Department of Sustainable Development & Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002] Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002])

FACT SHEET

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Version 05-23-2002

Project Shipboard Hazard and Defense (SHAD)

DTC Test 68-50

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The purpose of Deseret Test Center (DTC) Test 68-50 was to determine the potential casualty area and associated casualty levels for the F-4/AB45Y-4/PG2 weapon system. The weapon system disseminated an aerosol over a 40-50 kilometer downwind grid, encompassing a segment of the Eniwetok Atoll and an array of five Army light tugs.

The agent employed in this test was staphylococcal enterotoxin, Type B, a toxin produced by certain strains of the common bacterium known as Staphylococcus aureus. A two percent concentration of uranine dye (sodium fluorescein) was incorporated into the staphylococcal enterotoxin, during the drying cycle at the production plant. The dye served as a tracer for the agent. *Bacillus subtilis var. niger* (BG) was also used as a tracer of the agent aerosols.

The USS *Granville S. Hall* (YAG-40) was assigned to DTC Test 68-50, along with five Army light tugs. Aircraft assigned to the 4533rd Tactical Test Squadron, 33rd Tactical Fighter Wing, disseminated agent and tracers during the test.

DTC Test 68-50 was conducted at Eniwetok Atoll, Marshall Islands during September and October 1968.

Test Name	DTC Test 68-50
Testing Organization	US Army Deseret Test Center
Test Dates	September and October 1968
Test Location	Testing was conducted at Eniwetok Atoll, Marshall Islands.
Test Operations	The F-4/AB45Y-4/PG2 weapon system disseminated an aerosol over a 40-50 kilometer downwind grid, encompassing a segment of the Eniwetok Atoll and an array of five light tugs.
Participating Services	US Army, US Navy, US Air Force, and Deseret Test Center personnel
Units and Ships Involved	USS *Granville S. Hall* (YAG-40) Five Army light tugs 4533rd Tactical Test Squadron, 33rd Tactical Fighter Wing (F-4E aircraft)
Dissemination Procedures	Aerial-delivered aerosolized agent and agent tracers
Agents, Simulants, Tracers	Staphylococcal enterotoxin, Type B Bacillus subtilis var. niger (BG) Uranine dye (sodium fluorescein)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Bacillus subtilis var. niger (Bacillus globigii [BG]) The American Type Culture Center characterizes Bacillus subtilis var. niger as a BioSafety Level-1 (BSL-1) bacterium. The Centers for Disease Control and Prevention define BSL-1 as suitable for work involving well-characterized agents not known to consistently cause disease in healthy adult humans. (Sources: American Type Culture Collection data sheet, http://www.atcc.org/ [as of January 11, 2002]. *Biosafety in Microbiological and Biomedical Laboratories*, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention and National Institutes of Health, 4th ed., p. 17, April 1999, U.S. Government Printing Office, Washington).

	Staphylococcal enterotoxin, Type B (PG2) Produced by Staphylococcus aureus strains. It may be aerosolized or used to sabotage food supplies causing food poisoning. Symptoms are present within three to twelve hours after aerosol exposure and are characterized by fever, chills, headache, myalgia and nonproductive cough. Some may develop shortness of breath and retrosternal chest pain. Fever may last two to five days, and cough may persist for up to four weeks. Swallowing staphylococcal enterotoxin may also cause nausea, vomiting, and diarrhea. staphylococcal enterotoxin is not generally thought of as a lethal agent; however, it may incapacitate soldiers for one to two weeks. Military protective masks are effective against exposure. Treatment is limited to supportive care through ventilation and fluid management. The incapacitating dose is 30 mg/person by inhalation. (Source: Medical NBC Website, http://www.nbc-med.org/others/Default.html [as of April 2, 2002.] Uranine dye (sodium fluorescein) used as a tracer can cause a mild reaction in about one in ten people exposed. Exposure to dye dust through breathing or skin contact can result in adverse health effects such as asthma, eczema, and severe allergic reactions. http://www.cdc.gov/niosh/hc13.html

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Version 12-02-2002

Deseret Test Center

Cliff Rose

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The primary test objective of Cliff Rose (DTC Test 68-52) was to evaluate three CS weapon systems in tropical and semi-tropical environments: the BLU-52A/B chemical bomb; the CS2, XM28 helicopter sling-mounted dispenser; and, the XM-920 E-2 fuze and burster-bomb system. These CS weapon systems were all bulk-CS-filled terrain-denial systems and were evaluated in forest, open water (paddy), jungle, high grass, and open terrain, in terms of periods of denial to unmasked, walking test subjects, pattern sizes, and contamination density.

For this test, ortho-chlorobenzylidene malontrile (CS2), a white crystalline powder riot-control agent, was dispersed by Air Force low and high speed tactical aircraft, burster devices, and a UH-1 type helicopter.

While the United States does not classify CS2 as a chemical warfare agent, Deseret Test Center managed Cliff Rose as a matter of convenience. Testing CS2 was not part of a chemical-biological warfare agent assessment.

Cliff Rose was conducted between September 22, 1967 – January 18, 1968 at Ft. Stewart, Georgia (Phase I) and at an unspecified location in the Panama Canal Zone (Phase II).

Test Name	Cliff Rose (DTC Test 68-52)
Testing Organization	US Army Deseret Test Center
Test Dates	September 22, 1967 – January 18, 1968
Test Location	Ft. Stewart Georgia and the Panama Canal Zone
Test Operations	To evaluate three CS weapon systems in tropical and semi-tropical environments: the BLU-52A/B chemical bomb; the CS2, XM28 helicopter sling-mounted dispenser; and, the XM-920 E-2 fuze and burster-bomb system. CS2 was dispersed by Air Force low and high speed tactical aircraft, burster devices, and a UH-1 type helicopter.
Participating Services	US Army, US Air Force, and Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Three types of CS2 munitions, including the BLU-52A/B chemical bomb, the XM28 dispenser system, and the XM-920 E-2 fuze and burster system were tested.. The BLU-52A/B bombs were delivered by US Air Force low and high speed aircraft. The XM28 sling-mounted dispenser released CS2 from a UH-1 type helicopter.
Agents, Simulants, Tracers	Ortho-chlorobenzylidene malontrile (CS2)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	<u>CS2 Riot – Control Agent</u> CS2 is one of several chemicals commonly called "Tear Gas." CS2 is a white, crystalline powder and is dispersed into the air as either an aerosol or powder. The chemical name for CS2 is ortho chlorobenzylidene malononitrile. It is chemically

	identical to CS but differs in its physical characteristics. This chemical is an incapacitating/ riot-control agent that acts as a contact irritant on the exposed body surfaces (eyes and skin), and on the respiratory tract. Exposure to CS2 causes burning, irritation, tearing and pain in the eyes. Airway symptoms include burning, sneezing, coughing, shortness of breath and increased secretions, such as runny nose and increased salivation. High concentrations of CS2 can cause blistering of the skin. With commonly used concentrations, these effects are short-term and the potential for long-term health consequences is low. (Sources: Riot-Control Agents (chap. 6), in US Army Medical Research Institute of Chemical Defense, Medical Management of Chemical Casualties Handbook, 3rd edition, 1998; Sidell FR, Riot Control Agents (chap. 12), in Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997, p. 310-6. http://www.metrokc.gov/health/hazard/riotcontrol.htm#cs [as of September 26, 2002] Cornell University, http://msds.pdc.cornell.edu/msds/siri/files/chl/chlfz.html [as of August 26, 2002]).

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Version 10-09-2002

Deseret Test Center

DTC Test 68-53

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The primary test objective of DTC Test 68-53 was to establish safety distances downwind of CS2 drop zones. A secondary objective required the determination of agent deposition patterns, percent of agent recovery, and airborne agent particle size in defining direct assault effects such as those related to rescue missions.

Five types of CS2 munitions, including the BLU-52A/B, Mk77, Mk20, and XM925 bombs and the XM28 dispenser system, were tested in flat, open terrain. The BLU-52A/B bombs were delivered by A-4/Skyhawk aircraft. The Mk77 and Mk20 bombs were deployed in pairs fromA-4/Skyhawk aircraft. The XM925 drum was tested statically and in dynamic drops from a CH47 helicopter. Bag submunitions were released from an XM28 dispenser carried by a UH-1B helicopter.

While the United States does not classify CS2 as a chemical warfare agent, Deseret Test Center managed DTC Test 68-53 as a matter of convenience. Testing CS2 was not part of a chemical-biological warfare agent assessment.

DTC Test 68-53 was conducted during the period April to December 1969 at Dugway Proving Ground, Utah.

Test Name	DTC Test 68-53
Testing Organization	US Army Deseret Test Center
Test Dates	April – December 1969
Test Location	Dugway Proving Ground, Utah
Test Operations	DTC Test 68-53 established safety distances downwind of CS2 riot control agent drop zones. The test also determined agent deposition patterns, percent of agent recovery, and airborne agent particle size in defining direct assault effects such as those related to rescue missions.
Participating Services	Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Five types of CS2 munitions, including the BLU-52A/B, Mk77, Mk20, and XM925 bombs and the XM28 dispenser system, were tested in flat, open terrain. The BLU-52A/B bombs were delivered by A-4/Skyhawk aircraft. The Mk77 and Mk20 bombs were deployed in pairs fromA-4/Skyhawk aircraft. The XM925 drum was tested statically and in dynamic drops from a CH47 helicopter. Bag submunitions were released from an XM28 dispenser carried by a UH-1B helicopter.
Agents, Simulants, Tracers	Ortho-chlorobenzylidene malontrile (CS2)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	CS2 Riot–Control Agent CS2 is one of several chemicals commonly called "Tear Gas." CS2 is a white, crystalline powder and is dispersed into the air as either an aerosol or powder. The chemical name for CS2 is ortho-chlorobenzylidene

	malononitrile. It is chemically identical to CS but differs in its physical characteristics. This chemical is an incapacitating/riot-control agent that acts as a contact irritant on the exposed body surfaces (eyes and skin), and on the respiratory tract. Exposure to CS2 causes burning, irritation, tearing and pain in the eyes. Airway symptoms include burning, sneezing, coughing, shortness of breath and increased secretions, such as runny nose and increased salivation. High concentrations of CS2 can cause blistering of the skin. With commonly used concentrations, these effects are short-term and the potential for long-term health consequences is low. (Sources: Riot-Control Agents (chap. 6), in US Army Medical Research Institute of Chemical Defense, Medical Management of Chemical Casualties Handbook, 3rd edition, 1998; Sidell FR, Riot Control Agents (chap. 12), in Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997, p. 310-6. http://www.metrokc.gov/health/hazard/riotcontrol.htm#cs [as of September 26, 2002]Cornell University, http://msds.pdc.cornell.edu/msds/siri/files/chl/chlfz.html [as of August 26, 2002]).

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Version 06-30-2003

Deseret Test Center
Project SHAD

Folded Arrow

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' and ashore installations' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The purpose of Folded Arrow was to study over-ocean downwind travel of a biological aerosol material when disseminated from a submarine-biological system; to demonstrate the submarine weapon system capability to carry out an effective biological attack against an island complex; and to study the effects of a biological attack against a naval port facility. The data obtained from the test were related to mathematically generated estimates of casualties expected from exposure to *Venezuelan equine encephalitis*.

Six trials (Group A trials) were designed to ascertain the downwind travel of a biological aerosol produced by the submarine-biological-disseminator system. The submarine released the biological simulant *Bacillus globigii*. The Group A trials were conducted at sea approximately 80 nautical miles south-southwest of Oahu, Hawaii. Five light tugs stationed at pre-determined locations along the downwind path of the aerosol conducted over-ocean sampling.

Two trials (Group B) demonstrated the system's capability to attack an island complex. Sampling stations were established at 15 locations on the northern half of Oahu (that portion of the island north of Pearl City) to best depict movement of the aerosol cloud across the island. *Bacillus globigii* simulant was used in both trials.

The port facility attack consisted of two trials (Group C) during which the submarine disseminated *Bacillus globigii* simulant along a line offshore from Kaneohe Marine Corps Air Station.

In addition to demonstrating the feasibility of a submarine-biological-disseminator, Folded Arrow was also designed to determine the biological-contamination hazard to which the submarine crew would be subjected in operating the system. To determine the contamination hazard to the crew, an evaluation program was designed. This consisted primarily of aerosol and contact (swab) samples taken from numerous points inside and outside the submarine before, during, and after aerosol dissemination. Under the conditions of this test, no contamination of the submarine's interior was detected. Calcium hypochlorite and betapropriolactone were both used as decontaminants during this test. No trace of betapropriolactone vapor was detected within the submarine during the decontaminant tank-filling operation or during the system decontamination phase accomplished while under way.

Folded Arrow was conducted in the vicinity of the island of Oahu, Hawaii during the period of April and May 1968.

Test Name	Folded Arrow (DTC Test 68-71)
Testing Organization	US Army Deseret Test Center
Test Dates	April – May 1968
Test Location	Oahu, Hawaii and surrounding waters
Test Operations	To study over-ocean downwind travel of a biological aerosol material when disseminated from a submarine-biological system and to demonstrate the submarine weapon system capability to carry out an effective biological attack against an island complex; and a naval port facility.
Participating Services	US Navy, US Marine Corps, Deseret Test Center personnel
Units and Ships Involved	USS *Carbonero* (SS-337) USS *Granville S. Hall* (YAG-40) Five Army light tugs
Dissemination Procedures	*Bacillus globigii* was disseminated from a fleet submarine using a submarine-biological-disseminator.
Agents, Simulants, Tracers	*Bacillus globigii*
Ancillary Testing	Not identified
Decontamination	Calcium hypochlorite betapropriolactone
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* Now considered to be *Bacillus subtilis var. niger,* a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease.

They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection).(Sources: Tuazon CU, *Other Bacillus Species* (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Betapropriolactone

Modern uses for betapropriolactone include vaccines, enzymes, tissue grafts, and surgical instruments; to sterilize blood plasma, water, milk, and nutrient broth; and as a vapor-phase disinfectant in enclosed spaces. Its sporicidal action kills vegetative bacteria, pathogenic fungi, and viruses. The primary routes of potential human exposure to betapropriolactone are inhalation, ingestion, and dermal contact. There is evidence betapropriolactone is a carcinogen; however, the results of animal testing in mice, rats, hamsters, and guinea pigs are questionable due to a lack of controls in the study. An International Agency for Research on Cancer (IARC) working group reported no data are available to evaluate the carcinogenicity of betapropriolactone in humans.(Source: Department of Health and Human Services, National Institutes of Health website: http://ntp-server.niehs.nih.gov/htdocs/8_RoC/RAC/betapropriolactone.html).

	Calcium hypochlorite. Modern uses for calcium hypochlorite include bleach, cleaning solutions, and disinfectants for drinking water and wastewater purification systems and swimming pools. When released into the air, it is broken down by sunlight and compounds commonly found in the air. It does not accumulate in the food chain. You can be exposed to low levels if you use disinfectants like household bleach. You can also be exposed swimming in pools where calcium hypochlorite has been added to kill bacteria. Calcium hypochlorite if ingested in small amounts (3-6% hypochlorite) can cause gastrointestinal irritation. If a more concentrated amount is ingested (10% or higher hypochlorite), effects can range from corrosive injuries to the mouth, throat, esophagus and stomach with bleeding, perforation and eventually death. Inhalation of chlorine gas may cause nasal irritation, sore throat, and coughing. Contact with skin may cause burning pain, inflammation, and blisters. Long-term exposure to low-levels of hypochlorite can cause dermal irritation. The International Agency for Research on Cancer (IARC) has determined that hypochlorite salts are not classifiable as to their carcinogenicity to humans.(Source: ATSDR http://www.atsdr.cdc.gov/tfacts184.html) as of June 3, 2003)

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Version 10-09-2002

Deseret Test Center
Project SHAD

DTC Test 69-10

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

In DTC Test 69-10, units of a US Marine Corps Ready Group were subjected to a simulated chemical agent spray attack while engaged in an amphibious assault. The purpose of the test was to determine the operational effects of a persistent, toxic, chemical agent spray attack on US amphibious forces. The objectives of the test were to assess the performance degradation of troops wearing protective clothing and to illustrate the effectiveness of existing chemical weapons. Contamination of ships and equipment supporting the landing was also assessed.

The test was conducted in two parts: aerial spray attacks against Battalion Landing Team (Minus), BLT(-), and company sized USMC amphibious landing forces; and, an aerial spray attack against the primary control ship of an amphibious assault force. During all trials, sampling was conducted on exposed personnel, and their clothing, to determine if they were contaminated with the simulant. Performance of the troops, the landing craft crews, and the

ship's crew was evaluated with regard to the response of personnel to the attack and their subsequent ability to operate in a simulated toxic environment.

Missions flown by Marine A-4 aircraft carrying Aero 14B spray tanks delivered trioctyl phosphate (tri [2-ethylhexyl] phosphate) to simulate VX nerve agent. The USS *Fort Snelling* (LSD-30) was the target ship for the ship trial.

DTC Test 69-10 was conducted in May 1969 on the beaches of Vieques island, six miles east of Puerto Rico.

Test Name	DTC Test 69-10
Testing Organization	US Army Deseret Test Center
Test Dates	May 1969
Test Location	Vieques island, six miles east of Puerto Rico
Test Operations	To determine the operational effects of a persistent, toxic, chemical agent spray attack on US amphibious forces.
Participating Services	US Navy, US Marine Corps, Deseret Test Center personnel
Units and Ships Involved	Landing Force Carib 1-69/BLT 1/8 (attached and supporting personnel from 2d Marine Division)VMA-324, MAG-32, 2d Marine Aircraft Wing USS *Fort Snelling* (LSD-30)
Dissemination Procedures	Sprayed from Marine A-4 aircraft equipped with Aero 14B spray tanks.
Agents, Simulants, Tracers	Tri (2-ethylhexyl) phosphate
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Trioctyl phosphate (tri(2-ethylhexyl) phosphate) (TOF) Used as a nontoxic simulant for VX nerve agent. TOF is a viscous, colorless or pale yellow liquid. It can irritate the eyes, skin, and respiratory tract on contact. It can cause cancer in some animal species, but this has not been demonstrated in humans.

	(Sources: NLM TOXNET, Trioctyl phosphate 1806-54-8 or Tris(2-ethylhexyl)phosphate 78-42-2, HSDB Human Health Effects and Animal Toxicity Studies, available at http://toxnet.nlm.nih.gov. http://physchem.ox.ac.uk/MSDS/TR/tris(2-ethylhexyl)phosphate.html [as of September 25, 2002] and http://www.ilo.org/public/english/protection/safework/cis/products/icsc/dtasht/icsc09/icsc0968.pdf [as of September 25, 2002]).

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Version 10-09-2002

Deseret Test Center

DTC Test 69-12

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

In 1967 and 1968, Deseret Test Center Test conducted DTC Test 68-13 (Rapid Tan I, II, III) jointly with the United Kingdom and Canada. Rapid Tan was designed to investigate the extent and duration of hazard following a Tabun, Soman or V nerve agent attack. DTC Test 69-12 was planned as a more sophisticated test than Rapid Tan. DTC Test 69-12 was originally scheduled for conduct near Fort Greely, Alaska; however, the test site was moved to Edgewood Arsenal, Maryland. Only three trials (of 54 scheduled) were completed prior to the imposition of open-air toxic test restrictions and the suspension of the test.

The three completed DTC Test 69-12 trials were conducted at Edgewood Arsenal, Maryland during the spring of 1969.

Test Name	DTC Test 69-12
Testing Organization	US Army Deseret Test Center
Test Dates	Spring 1969
Test Location	Edgewood Arsenal, Maryland
Test Operations	To determine rate of evaporation of Tabun, Sarin, Soman, and VX as a function of contamination density, drop size, and terrain cover under a variety of meteorological conditions in a temperate environment.
Participating Services	Deseret Test Center Personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Not identified
Agents, Simulants, Tracers	Sarin Nerve Agent Soman Nerve Agent Tabun Nerve Agent VX Nerve Agent
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of

	Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term health effects. (Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002]Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.) Soman Nerve Agent (GD) Soman is a colorless liquid, which gives off an odor of rotting fruit when vaporizing. The vapor is colorless. Soman is a persistent agent that can easily remain in a particular area for a day or longer, depending on the atmospheric conditions. Acute health effects associated with exposure to soman include a runny nose, tightness in the chest, constriction of the pupils, difficulty in breathing, coma, and death. There is little information available regarding the long-term human health effects of exposure to soman. (Source: http://www.sbccom.army.mil/services/edu/soman.htm Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997.) Tabun Nerve Agent (GA) Tabun is an amber, non-persistent liquid, which gives off little odor when vaporizing. The vapor is colorless. When exposed to tabun, the symptoms a victim will experience include a runny nose, tightness in the chest, constriction of the pupils, difficulty breathing,

	and nausea. Ultimately the victim will become comatose and will suffocate as a consequence of convulsive spasms. Tabun is mainly absorbed through the skin; however, vapors can also be hazardous. If a person does not receive an immediately lethal dose, death will occur after approximately 20 minutes. Those receiving a less than lethal dose who do not receive immediate medical care may suffer permanent neurological damage. There is little information available regarding the long-term human health effects of exposure to low doses of tabun. (Source: http://www.sbccom.army.mil/services/edu/tabun.htm Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997. VX Nerve Agent – (Synonyms: Phosphonothioic acid, VX) VX nerve agent is extremely lethal. It is an oily liquid that is clear, odorless, and tasteless. Death usually occurs within 10-15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: constriction of pupils, headaches, runny nose, salivation, tightness in the chest, nausea, vomiting, anxiety, difficulty in thinking, muscle twitches, tremors, and weakness. With severe exposure, symptoms progress to convulsions and respiratory failure. There is little information available regarding the long-term human health effects of exposure to low doses of VX.

	(Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002] Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997. SBCCOM Online, Edgewood Chemical Biological Center http://in1.apgea.army.mil:80/RDA/msds/vx.htm [as of April 2, 2002] World Health Organization, Department of Sustainable Development & Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002] Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002]).

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Version 10-09-2002

Deseret Test Center

DTC Test 69-14

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of DTC Test 69-14 was to determine the hazards associated with inadvertent release of the MC-1 bomb during takeoff and landing, as well as the hazards resulting from bomb damage caused by hostile fire. The secondary objective was to determine the adequacy of leak suppressant and disposal procedures for damaged MC-1 bombs.

Simulant and/or water-filled 750 pound MC-1 bombs with or without bursters were used in the test. The simulant used was di (2-ethylhexyl) phthalate (DEHP.)

DTC Test 69-14 was conducted between July and November 1971 at Dugway Proving Ground, Utah.

Test Name	DTC Test 69-14
Testing Organization	US Army Deseret Test Center
Test Dates	July – November 1971
Test Location	Dugway Proving Ground, Utah
Test Operations	DTC Test 69-14 consisted of 26 trials. Eighteen bullet-impact trials and eight simulated inadvertent releases were conducted. The primary test objective was to determine the hazards associated with inadvertent release of the MC-1 bomb during takeoff and landing and to determine the adequacy of leak suppressant and disposal procedures for damaged MC-1 bombs.
Participating Services	US Army, US Air Force, and Deseret Test Center Personnel
Units and Ships Involved	F-4 aircraft with MC-1 bombs
Dissemination Procedures	In the simulated inadvertent release trials, an MC-1 bomb was released from an F-4 aircraft. All bombs were equipped with the MAU-91 tail fin mounted "lo-drag" display. Six releases were made over a dry lake bed. These were followed by releases over concrete. For the bullet-impact trials, bombs were again filled with water and equipped with the central burster. Both water-filled and simulant-filled bombs were subjected to 50- and 30-caliber fire, 20mm armor piercing incendiary fire and 20mm high explosive incendiary fire.
Agents, Simulants, Tracers	Di (2-ethylhexyl) phthalate (DEHP)
Ancillary Testing	Not identified
Decontamination	Not identified

Potential Health Risks Associated with Agents, Simulants, Tracers	Di (2-ethylhexyl) phthalate (DEHP) This chemical is commonly present in flexible plastics and therefore widespread in the environment and of some concern for the general population. While low level exposures have not been shown to cause serious health effects, acute exposure to high levels of this chemical can cause irritation of the skin, eyes, and respiratory tract. DEHP has caused cancer in some animal testing, but the relevance of this testing to cancer in humans is uncertain. (Sources: DHHS PHS ATSDR ToxFAQs, Di(2-ethylhexyl)phthalate #117-81-7, April 1993, and Toxicological Profile for Di(2-ethylhexyl)phthalate (DEHP), draft for public comment, September 2000, both available at http://www.atsdr.cdc.gov as of October 1, 2002. Also WHO International Agency for Research on Cancer (IARC) Monographs on the Evaluation of Carcinogenic Risks to Humans (vol. 77, Some Industrial Chemicals updated February 23, 2000), available at http://193.51.164.11/htdocs/announcements/vol77.htm as of October 4, 2002.)

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Version 10-09-2002

Deseret Test Center
Project SHAD

DTC Test 69-31

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The primary purpose of DTC Test 69-31 was to evaluate the continued effectiveness of the Shipboard Toxicological Operational Protection System (STOPS) of the USS *Herbert J. Thomas* (DD-833). The ship was challenged by five chemical vapor attacks using methylacetoacetate, a simulant for Sarin nerve agent. An additional 11 attacks were conducted in which the USS *Herbert J. Thomas* was enveloped with the nonpathogenic biological aerosol, *Bacillus globigii* (BG).

A MARS generator mounted on the bow of the ship was used to disseminate methylacetoacetate; PCF "swift boats" were used to disseminate BG during simulated biological warfare agent attacks.

DTC Test 69-31 trials were conducted in the Pacific Ocean, off the coast of San Diego, California, during the period August 19 - September 4, 1968.

Test Name	DTC Test 69-31
Testing Organization	US Army Deseret Test Center
Test Dates	August 19 – September 4, 1968
Test Location	Testing was conducted in the Pacific Ocean, off the coast of San Diego, California
Test Operations	To test the Shipboard Toxicological Operational Protective System (STOPS) using methylacetoacetate, a simulant for Sarin nerve agent (GB) and *Bacillus globigii*, a nonpathogenic biological aerosol.
Participating Services	US Navy, Deseret Test Center personnel
Units and Ships Involved	USS *Herbert J. Thomas* (DD-833)
Dissemination Procedures	MARS generator to disseminate MAAPCF "swift boats" for BG dissemination
Agents, Simulants, Tracers	*Bacillus globigii* (BG) Methylacetoacetate
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger*, a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-

	developing health effects would be very unlikely (except perhaps as a complication of the acute infection). (Sources: Tuazon CU, Other Bacillus Species (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, Bacillus subtilis Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.) Methylacetoacetate (MAA) This compound was used as a simulant. While acute exposure has been associated with irritation of skin, eyes, respiratory tract, and digestive tract, there is little or no evidence of long-term or late-developing health effects and it is not known to cause cancer in animal testing. (Sources: NLM TOXNET, Methyl acetoacetate 105-45-3, HSDB Human Health Effects and Animal Toxicity Studies, available at http://toxnet.nlm.nih.gov. http://hazard.com/msds/tox/f/q4/q936.html [as of January 28, 2002] and http://www.hbcollege/chem/lab/organic/gilbert3e/resources/studenttools/dl/e_mmsds.pdf)

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Version 05-23-2002

Project Shipboard Hazard and Defense (SHAD)

DTC Test 69-32

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The purpose of Deseret Test Center (DTC) Test 69-32 was to examine the effect of solar radiation on the viability of aerosolized Serratia marcescens and Escherichia coli after being aerially disseminated in a temperate marine environment during time periods about sunrise and sunset.

Twenty-seven field trials were conducted (14 Serratia marcescens and 13 Escherichia coli). R eleases were made from two Aero 14B spray tanks wing-mounted on an A-4C aircraft. *Bacillus subtilis var. niger* (BG) with fluorescent tracer suspension was released from one tank while either *Serratia marcescens* or *Escherichia coli* was simultaneously released from the other. Calcofluor was added to the BG as the physical fluorescent tracer. All trials were conducted using ten percent calcofluor added to the BG

The USS *Granville S. Hall* (YAG-40), along with five Army light tugs, was assigned to provide surface support to DTC Test 69-32. The five tugs, each converted to serve as an ocean-going sampling platform and laboratory, were employed as target vessels. Agent and tracer dissemination by A-4C aircraft commenced 1.6 kilometers downwind of the primary laboratory ship (YAG-40) and continued downwind for approximately 3.2 kilometers beyond the last sampling support tug.

DTC Test 69-32 was conducted at sea southwest of the Hawaiian Islands during the period of April 30 to June 28, 1969.

Test Name	DTC Test 69-32
Testing Organization	US Army Deseret Test Center
Test Dates	April 30 – June 28, 1969
Test Location	Testing was conducted at sea southwest of the Hawaiian Islands.
Test Operations	To examine the effect of solar radiation on the viability of aerosolized Serratia marcescens and Escherichia coli after being aerially disseminated in a temperate marine environment during time periods about sunrise and sunset.
Participating Services	US Army, US Navy, US Air Force, Deseret Test Center personnel
Units and Ships Involved	USS *Granville S. Hall* (YAG-40) Five Army light tugs VC-1 (previously designated VU-1, Utility Squadron One) the Blue Aiis (Blue Warriors) Squadron, stationed at Barbers Point, Hawaii, provided a Navy A-4C as a disseminator aircraft. Patrol Squadron Six (PATRON SIX), Fleet Air Wing Two, provided two P3V *Orion* aircraft as airborne command posts.
Dissemination Procedures	Releases were made from two Aero 14B spray tanks wing mounted on an A-4C aircraft. *Bacillus subtilis var. niger* (BG) with fluorescent tracer suspension (calcofluor) was released from one tank while either *Serratia marcescens* or *Escherichia coli* was simultaneously released from the other.
Agents, Simulants, Tracers	*Serratia marcescens* (SM) *Escherichia coli* *Bacillus subtilis var. niger* (BG) Calcofluor (fluorescent brightner 28)
Ancillary Testing	Not identified
Decontamination	Not identified

Potential Health Risks Associated with Agents, Simulants, Tracers	*Serratia marcescens* (SM) In 1969 Serratia marcescens was recognized as having a limited pathogenic capability and its use as a bacterial marker for studying the dissemination of bacterial aerosols was discontinued. It is an opportunistic pathogen, causing infections of the endocardium, blood, wounds, and urinary and respiratory tracts. (Source: U.S. Army Activity in the U.S. Biological Warfare Programs, Volume II, Appendix E, p. E-6, p. E-7, February 24, 1977; Miller-Keane Medical Dictionary, 2000, http://my.webmd.com/content/asset/miller_keane_30189 [as of January 9, 2002]). *Escherichia coli* (Synonym: E. Coli) E. coli is one of the most common bacteria in man's environment. Most animals and humans have it in their digestive systems, where it does no harm. E. coli can cause severe stomach cramps, diarrhea, bloody stools, and kidney failure. Some who are exposed to E. coli may experience mild irritation of the stomach and intestines that goes away without treatment, while for others the bacteria can be deadly. (Source: http://my.webmd.com/content/article/3606.464 [as of January 9, 2002]). *Bacillus subtilis var. niger* (Bacillus globigii [BG]) The American Type Culture Center characterizes Bacillus subtilis var. niger as a BioSafety Level-1 (BSL-1) bacterium. The Centers for Disease Control and Prevention define BSL-1 as suitable for work involving well-characterized agents not known to consistently cause disease in healthy adult humans. (Sources: American Type Culture Collection data sheet, http://www.atcc.org/ [as of January 11, 2002]. *Biosafety in Microbiological and Biomedical Laboratories*, US Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention and National Institutes of Health, 4th ed., p. 17, April 1999, U.S. Government Printing Office, Washington).

	Calcofluor (fluorescent brightener 28, Calcofluor White ST) Used as a fluorescent tracer with BG. $C_{40}H_{42}N_{12}Na_2O_{10}S_2$. Testing on laboratory animals indicates calcofluor may cause mild eye irritation. (Source: *http://hazard.com/msds/tox/f/q127/q679.html* [as of April 30, 2002])

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Version 10-09-2002

Deseret Test Center

DTC Test 69-75

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The objective of Deseret Test Center (DTC) Test 69-75 was to investigate the effectiveness of the F-4/A/B 45Y-2/TX weapon system to reduce wheat crop yields in selected geographic areas. The objective was subdivided into other tasks: determine the downwind travel of agent TX released from the A/B 45Y-2 spray tank; estimate the yield reduction and loss of wheat crops attacked by this weapon system; study the effectiveness of killed TX as a simulant for agent TX; and, evaluate the adequacy to predict downwind dosages of TX.

TX is the agent symbol for the fungus *Puccinia graminis var. tritici*, commonly known as stem rust of wheat. Killed TX is defined as spores killed by a gaseous mixture of ethylene oxide. Dead spores are those that have died as a result of causes other than intentional killing.

Four killed TX trials and seven live agent trials were conducted. All trials were conducted in the vicinity of Yeehaw Junction, Florida, from October 31 to December 1, 1968.

Test Name	DTC Test 69-75
Testing Organization	US Army Deseret Test Center
Test Dates	October 31 – December 1, 1968
Test Location	In the vicinity of Yeehaw Junction, Florida
Test Operations	To investigate the effectiveness of the F-4/A/B 45Y-2/TX weapon system to reduce wheat crop yields in selected geographic areas.
Participating Services	US Air Force, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	TX was sprayed from an A/B 45Y-2 spray tank mounted on an F-4 aircraft.
Agents, Simulants, Tracers	*Puccinia graminis var. tritici* (TX)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Puccinia graminis tritici* (TX) This fungal species is toxic to plants, and therefore was considered a potential biological warfare agent directed against agricultural crops. It is not ordinarily considered to have either short-term or long-term human health effects. (Sources: Zajtchuk R., ed., Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997, p. 60, 460. Also http://www.cbwinfo.com/Biological/PlantPath/PG.html as of October 4, 2002.)

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Deseret Test Center
Project SHAD

DTC Test 70-C

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The purpose of DTC Test 70-C was to characterize the naturally occurring airborne particulates in a marine atmosphere for background data applicable to the operation of biological detectors under development and to detection concepts under consideration. An additional test objective was to assess the marine and land/sea interface for phosphorescent and fluorescent emission spectra of resident flora and fauna.

As originally planned, DTC Test 70-C was to comprise 10 days of sampling each quarter of fiscal years 1973 and 1974. Ultimately, trials were conducted only twice - once in October 1972 and a again in February-March 1973. The US Naval Sealift Command ship USNS *Samuel Phillips Lee* (T-AGS 31) served as the sampling platform in October 1972. The USNS *Silas Bent* (T-AGS 26) served as the sampling platform in February and March 1973.

Test personnel used the ROYCO particle monitor sampler and the Aminco-Bowman spectrophotofluorometer analysis equipment to collect data on naturally occurring soluble and insoluble particles found in a marine environment. No chemical-biological simulants or agents were used in this test.

DTC Test 70-C trials took place in the Pacific Ocean. The first trial was conducted aboard the USNS *Samuel Phillips Lee* (T-AGS 31) between October 19 and 25, 1972 in an area 50 to 65 nautical miles off the coast of San Diego, California in the vicinity of San Clemente Island. The second trial began on February 9, 1973 when the USNS *Silas Bent* (T-AGS 26) departed San Diego, California and ended when the ship arrived at Rodman Naval Station, Balboa, Canal Zone, March 31, 1973.

Test Name	DTC Test 70-C
Testing Organization	US Army Deseret Test Center
Test Dates	October 19-25, 1972 February 9 – March 31, 1973
Test Location	In the Pacific Ocean off the coast of San Diego, California;In the Pacific Ocean between San Diego, California and Rodman Naval Station, Balboa, Canal Zone
Test Operations	To characterize the naturally occurring airborne particulates in a marine atmosphere for background data applicable to the operation of biological detectors. To assess the marine and land/sea interface for phosphorescent and fluorescent emission spectra of resident flora and fauna.
Participating Services	US Navy Sealift Command, Deseret Test Center personnel
Units and Ships Involved	USNS *Samuel Phillips Lee* (T-AGS 31) USNS *Silas Bent* (T-AGS 26)
Dissemination Procedures	Passive collection of naturally occurring particles in a marine environment
Agents, Simulants, Tracers	None
Ancillary Testing	Not identified
Decontamination	Not applicable
Potential Health Risks Associated with Agents, Simulants, Tracers	Not applicable.

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Deseret Test Center

DTC Test 70-11, Phase I, Subtest 3

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of DTC Test 70-11, Phase I, Subtest 3 was to provide deposition data for the advanced development test of the TMU-28/B spray system fitted with the MLU-40/B cutter assembly and to evaluate the F-100 and/or the F-4 Series Aircraft-TMU-28/U spray system with agent simulants bis (2-ethylhexyl) hydrogen phosphite and trioctyl phosphate.

Seven operational trials of the TMU28/B spray system were conducted at Dugway Proving Ground, Utah. Payloads of bis (2-ethylhexyl) hydrogen phosphite and trioctyl phosphate simulants for agent VX were dispersed under a specified range of meteorological and operational conditions. In single tank trials, aircraft released simulant at altitudes from 200 to 800 feet above ground level. In dual tank trials, releases occurred from 200 to 1,600 feet above ground level.

Mixtures containing either bis (2-ethylhexyl) hydrogen phosphite or trioctyl phosphate, with zinc cadmium sulfide fluorescent particles (FP), Photo Flo, Aerosol C-61 or Arlacel 83, and oil red dye were used in DTC Test 70-11, Phase I trials.

DTC Test 70-11, Phase I, Subtest 3, was conducted between June 1972 and November 1973 at Dugway Proving Ground, Utah.

Test Name	DTC Test 70-11, Phase I, Subtest 3
Testing Organization	US Army Deseret Test Center
Test Dates	June 1972 – November 1973
Test Location	Dugway Proving Ground, Utah
Test Operations	DTC Test 70-11, Phase I, Subtest 3 consisted of 7 trials. Payloads of bis (2-ethylhexyl) hydrogen phosphite and trioctyl-phosphite, simulants for agent VX, were dispersed under a specified range of meteorological and operational conditions.
Participating Services	US Air Force, Deseret Test Center personnel
Units and Ships Involved	USAF F-Series aircraft
Dissemination Procedures	In single tank trials, aircraft released simulant at altitudes from 200 to 800 feet above ground level. In dual tank trials, releases occurred from 200 to 1,600 feet above ground level.
Agents, Simulants, Tracers	bis (2-ethyl-hexyl) hydrogen phosphite trioctyl phosphate zinc cadmium sulfide (FP)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	bis (2-ethyl-hexyl) hydrogen phosphite This chemical compound used as an additive in industrial lubricants can cause acute irritation of the skin, eyes, and respiratory tract. There is insufficient evidence for or against long-term effects. (Source: NLM TOXNET, bis [2-ethylhexyl] hydrogen phosphite 3658-48-8, HSDB Human Health Effects, available at http://toxnet.nlm.nih.gov.)

trioctyl phosphate

Used as a nontoxic simulant for VX nerve agent. Trioctyl phosphate is a viscous, colorless or pale yellow liquid. It can irritate the eyes, skin, and respiratory tract on contact. It can cause cancer in some animal species, but this has not been demonstrated in humans.(Sources: NLM TOXNET, Trioctyl phosphate 1806-54-8 or Tris [2-ethylhexyl] phosphate 78-42-2, HSDB Human Health Effects and Animal Toxicity Studies, available at http://toxnet.nlm.nih.gov http://physchem.ox.ac.uk/MSDS/TR/tris(2-ethylhexyl)phosphate.html [as of September 25, 2002] and http://www.ilo.org/public/english/protection/safework/cis/products/icsc/dtasht/_icsc09/icsc0968.pdf [as of September 25, 2002]).

zinc cadmium sulfide (FP)

This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low.(Sources: National Research Council [National Academies], Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu [as of October 1, 2002]).

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Deseret Test Center

DTC Test 70-11, Phase I, Subtest 4

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of DTC Test 70-11, Phase I, Subtest 4 was to obtain data on the dissemination characteristics of the BIGEYE Dissemination Test Vehicle (DTV) containing agent VX simulant payload and to determine if the BIGEYE DTV could be used to obtain field data for evaluating hazards to US forces after a massive chemical attack with a ballistic weapon.

DTC Test 70-11, Phase I, Subtest 4 consisted of two trials. In each trial, one simulant-filled BIGEYE DTV was operationally delivered against an instrumented target array. Dissemination characteristics were estimated from the point of release to approximately one mile downwind.

Each DTV was filled with bis (2-ethylhexyl) hydrogen phosphite. The agent simulant was dyed with oil red dye. The BIGEYE DTV was mounted on and delivered by a TA 4F aircraft.

DTC Test 70-11, Phase I, Subtest 4 was conducted at Dugway Proving Ground, Utah in May 1974.

Test Name	DTC Test 70-11, Phase I, Subtest 4
Testing Organization	US Army Deseret Test Center
Test Dates	May 1974
Test Location	Dugway Proving Ground, Utah
Test Operations	DTC Test 70-11, Phase I, Subtest 4 consisted of 2 trials. In each trial, one simulant-filled BIGEYE DTV was operationally delivered against an instrumented target array. Dissemination characteristics were estimated from the point of release to approximately one mile downwind.
Participating Services	US Navy, Deseret Test Center personnel
Units and Ships Involved	TA-4F aircraft
Dissemination Procedures	Each DTV was filled with bis (2-ethylhexyl) hydrogen phosphite. The BIGEYE DTV was mounted on and delivered by a TA-4F aircraft.
Agents, Simulants, Tracers	bis (2-ethyl-hexyl) hydrogen phosphite
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	bis (2-ethyl-hexyl) hydrogen phosphite This chemical compound used as an additive in industrial lubricants can cause acute irritation of the skin, eyes, and respiratory tract. There is insufficient evidence for or against long-term effects.(Source: NLM TOXNET, bis (2-ethylhexyl) hydrogen phosphite 3658-48-8, HSDB Human Health Effects, available at http://toxnet.nlm.nih.gov.)

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Deseret Test Center

DTC Test 70-73

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of DTC Test 70-73 was to examine potential secondary aerosol hazards to friendly troops following a biological agent attack. A secondary aerosol is defined as bacterial, toxic, or viral particles resuspended in the air after once settling from a primary aerosol attack or after the biological agent has been intentionally deposited on surfaces.

The types of biological attack simulated in this study were (a) a liquid filled bomblet point source, (b) an aerial liquid spray line source, and (c) a surface deposition with dry biological spores. *Bacillus globigii* (BG) was used in these trials. Liquid BG was dispersed by an explosive test fixture or by a vehicle mounted generator. The dry form of BG was manually deposited with a gravity test fixture at an area designated for road deposit trials. Zinc cadmium sulfide (FP) was disseminated with the BG.

DTC Test 70-73 was conducted between July and December 1970 at Dugway Proving Ground, Utah.

Test Name	DTC Test 70-73
Testing Organization	US Army Deseret Test Center
Test Dates	July – December 1970
Test Location	Dugway Proving Ground, Utah
Test Operations	DTC Test 70-73 examined potential secondary aerosol hazards to friendly troops following a biological agent attack. The types of biological attack simulated in this study were (a) a liquid filled bomblet point source, (b) an aerial liquid spray line source, and (c) a surface deposition with dry biological spores.
Participating Services	Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Liquid BG was dispersed by an explosive test fixture or by a vehicle mounted generator. Dry BG was manually deposited with a gravity test fixture at an area designated for road deposit trials. Zinc cadmium sulfide (FP) was disseminated with the BG.
Agents, Simulants, Tracers	*Bacillus globigii* (BG) Zinc cadmium sulfide (FP)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger*, a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of

	the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection). (Sources: Tuazon CU, Other Bacillus Species (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, Bacillus subtilis Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.) Zinc cadmium sulfide (ZCdS) This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low.

	(Sources: National Research Council (National Academies), Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu as of October 1, 2002.)

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Deseret Test Center

DTC Test 70-74

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of DTC Test 70-74 was to determine the viability decay, and variability thereof, of microbiological organisms impacted on microfilaments in the Controlled Environmental Mobile Facility (a closed system) at Dugway Proving Ground, Utah, under a variety of environmental conditions.

A mixed slurry of *Serratia marcescens* and *Bacillus globigii* was used in each of 38 trials. The mixture was disseminated from a collison atomizer and the resulting aerosol was passed over stainless steel microfilaments wound on a series of 40 individual frames. In the viability decay study the frames were removed at selected intervals and exposed to one of six test conditions. Biological assay was conducted to determine the number of *Serratia marcescens-Bacillus globigii* organisms per time period. The biological decay-variability information was produced from those data.

DTC Test 70-74 was conducted between August 1972 and January 1973 at Dugway Proving Ground, Utah.

Test Name	DTC Test 70-74
Testing Organization	US Army Deseret Test Center
Test Dates	August 1972 – January 1973
Test Location	Dugway Proving Ground, Utah
Test Operations	A mixed slurry of *Serratia marcescens* and *Bacillus globigii* was used in each of 38 trials. The mixture was disseminated from a collison atomizer and the resulting aerosol was passed over stainless steel microfilaments wound on a series of 40 individual frames. In the viability decay study the frames were removed at selected intervals and exposed to one of six test conditions. Biological assay was conducted to determine the number of *Serratia marcescens-Bacillus globigii* organisms per time period. The biological decay-variability information was produced from those data.
Participating Services	Deseret Test Center personnel
Units and Ships Involved	None identified
Dissemination Procedures	The mixture was disseminated from a collison atomizer in the Controlled Environmental Mobile Facility (a closed system) at Dugway Proving Ground, Utah.
Agents, Simulants, Tracers	*Bacillus globigii* (BG) *Serratia marcescens* (SM)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger,* a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered

	harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection).(Sources: Tuazon CU, *Other Bacillus Species* (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.) *Serratia marcescens* (SM) This bacterial species can cause acute infections of the urinary tract, lung, bloodstream, and other body sites. These infections commonly occur in individuals whose health has already been compromised, and often in patients who are already hospitalized. Long-term or late-developing health effects would be very unlikely.(Source: Eisenstein, Barry I., Zaleznik, Dori F., Enterobacteriaceae (chap. 206), in *Principles and Practice of Infectious Diseases,* 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2303.)

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Deseret Test Center

DTC Test 73-30

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The objectives of DTC Test 73-30 were to determine viability decay of selected microorganisms impacted on microfilaments and exposed to a spectrum of sunlight conditions, and to obtain general trend information from a limited comparison of biological aerosol decay data using the microfilament and the free-floating aerosol techniques.

The microorganisms selected for determining viability decay in sunlight were *Serratia marcescens*, T-3 *coliphage*, and *Bacillus globigii*. *Serratia marcescens* and *Bacillus globigii* were used to obtain general trend data between the microfilament and free-floating aerosol techniques.

The microfilament technique trials employed the passage of a "charged" aerosol over microfilaments wound on stainless steel frames with a portion of the aerosol particles impacting on the microfilaments. This technique took place in the Controlled Environment Mobile Facility (CEMF). Free-floating aerosol technique trials used an E2 disseminator at the center of the Dugway Proving Ground West Vertical grid.

DTC Test 73-30 was conducted between February and June 1973 in the Controlled Environment Mobile Facility (CEMF) at Dugway Proving Ground, Utah.

Test Name	DTC Test 73-30
Testing Organization	Dugway Proving Ground, Utah
Test Dates	February-June 1973
Test Location	Dugway Proving Ground, Utah
Test Operations	The microfilament technique trials: "charged" aerosol particles passed over microfilaments wound on stainless steel frames with a portion of the aerosol particles impacting on the microfilaments. An E2 disseminator at the center of the Dugway Proving Ground West Vertical grid released free-floating aerosol particles.
Participating Services	Life Sciences Laboratory personnel, Dugway Proving Ground, Utah
Units and Ships Involved	Not identified
Dissemination Procedures	For the conventional aerosols trials an E2 disseminator was used.
Agents, Simulants, Tracers	*Bacillus globigii* *Serratia marcescens* T-3 *coliphage*
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* Now considered to be *Bacillus subtilis var. niger,* a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung,

heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection).(Sources: Tuazon CU, *Other Bacillus Species* (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Serratia marcescens

This bacterial species can cause acute infections of the urinary tract, lung, bloodstream, and other body sites. These infections commonly occur in individuals whose health has already been compromised, and often in patients who are already hospitalized. Long-term or late-developing health effects would be very unlikely. (Source: Eisenstein, Barry I., Zaleznik, Dori F., Enterobacteriaceae (chap. 206), in *Principles and Practice of Infectious Diseases*, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2303.)

T-3 *coliphage*

Coliphages are viruses (bacteriophages) that infect *E. coli* and are indicators of fecal contamination. There are two types of coliphages: male specific (F^+) and somatic. Male-specific coliphages are RNA or DNA viruses that infect via the F-pilus of male strains of *E. coli*. Somatic coliphages are DNA viruses that infect host cells via the outer cell membrane. (Source: http://www.epa.gov/nerlcwww/1601ap01.pdf [as of June 6, 2003]).

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Deseret Test Center

DTC Test 74-10, Phase I

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of DTC Test 74-10, Phase I was to evaluate and assess the vulnerability of a marine amphibious force in LVTP-7 vehicles when subjected to selected forms of chemical attack. Test objectives were to determine exterior and interior contamination levels on an LVTP-7 exposed to a chemical attack using thickened simulant; to determine vapor contamination level inside a closed LVTP-7 exposed to a simulated Sarin attack and to verify the effectiveness of the M8A3 CPU; to determine the difficulty involved in decontaminating an LVTP-7 after an attack with a methacrylate-thickened material; to determine the effect of amphibious operations on an LVTP-7 contaminated with thickened simulant and VX simulant; to determine the amount of contamination personnel will receive while egressing from a contaminated LVTP-7 in an uncontaminated area; to determine the amount of contamination an LVTP-7 picks up while traversing areas contaminated with VX simulant and thickened Soman simulant; and to determine the effects of thickened simulant on painted surfaces of an LVTP-7.

Dimethylmethylphosphonate thickened with 2.3 percent polymethyl methacrylate and dyed with 0.5 percent oil red dye was used to simulate thickened Soman. Trichloropropane was used to simulate Sarin, and bis-(2-ethylhexyl)hydrogen phosphite was used to simulate agent VX.

The thickened dimethylmethylphosphonate and later the bis-(2-ethylhexyl)hydrogen phosphite were disseminated using three pneumatic atomization nozzles mounted in a line. For the trial using trichloropropane, two atomizer nozzles connected to a single Tygon tube in a Sigma pump were used.

A variety of decontamination methods were used to clean the LVTP-7 vehicle of dimethylmethylphosphonate. These methods included soap and water; scrubbing with soap and hot water; steam cleaning; a 10 percent solution of monoethanolamine in water with 0.3 percent Van Waters and Rogers 9N9 nonionic surfactant; and hot monoethanolamine. M12A1 power-driven decontamination apparatuses were used to apply the decontamination solution to the LVTP-7. The vehicle was scrubbed with stiff-bristle brushes and brooms.

DTC Test 74-10, Phase I, consisting of nine trials, was conducted in September and October 1973 at Dugway Proving Ground, Utah.

Test Name	DTC Test 74-10, Phase I
Testing Organization	US Army Deseret Test Center
Test Dates	September – October 1973
Test Location	Dugway Proving Ground, Utah
Test Operations	DTC Test 74-10, Phase I consisted of nine trials. Thickened dimethylmethylphosphonate, bis-(2-ethylhexyl)hydrogen phosphite, and trichloropropane were disseminated using pneumatic atomization nozzles to evaluate and assess the vulnerability of a marine amphibious force in LVTP-7 vehicles when subjected to selected forms of chemical attack.
Participating Services	US Marine Corps, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Thickened dimethylmethylphosphonate and bis-(2-ethylhexyl)hydrogen phosphite were disseminated using three pneumatic atomization nozzles mounted in a line. For the trial using trichloropropane, two atomizer nozzles connected to a single Tygon tube in a Sigma pump were used
Agents, Simulants, Tracers	Dimethylmethylphosphonate bis-(2-ethylhexyl) hydrogen phosphite Trichloropropane
Ancillary Testing	Not identified
Decontamination	Methods included soap and water;scrubbing with soap and hot water; steam cleaning; a 10 percent solution of monoethanolamine in water with 0.3 percent Van Waters and Rogers 9N9 nonionic surfactant; andhot monoethanolamine.M12A1 power-driven decontamination apparatuses were used to apply the decontamination solution

	to the LVTP-7. The vehicle was scrubbed with stiff-bristle brushes and brooms.
Potential Health Risks Associated with Agents, Simulants, Tracers	Dimethylmethylphosphonate Dimethylmethylphosphonate is used as a flame retardant, a preignition additive for gasoline, an antifoam agent, a plasticizer and stabilizer, a textile conditioner and antistatic agent, and an additive for solvents and low-temperature hydraulic fluids. May be harmful if inhaled, swallowed or absorbed through the skin. It is a suspected carcinogen.(Sources: http://ntp-server.niehs.nih.gov/htdocs/LT-studies/tr323.html and http://physchem.ox.ac.uk/MSDS/DI/diemthyl_methylphosphonate.html [as of June 5, 2003]). bis (2-ethyl-hexyl) hydrogen phosphite This chemical compound used as an additive in industrial lubricants can cause acute irritation of the skin, eyes, and respiratory tract. There is insufficient evidence for or against long-term effects. (Source: NLM TOXNET, bis (2-ethylhexyl) hydrogen phosphite 3658-48-8, HSDB Human Health Effects, available at http://toxnet.nlm.nih.gov.) Trichloropropane Trichloropropane is a synthetic chemical that is also known as allyl trichloride, glycerol trichlorohydrin, and trichlorohydrin. It is a colorless, heavy liquid with a sweet but strong odor. It evaporates very quickly and small amounts dissolve in water. It is used as an industrial solvent, paint and varnish remover, and cleaning and degreasing agent. Exposure to high levels for a short time causes eye and throat irritation. (Source: http://www.atsdr.cdc.gov/tfacts57.html and http://www.osha-slc.gov/fts/chemicalsmapling/data/CH_273200.html [as of June 5, 2003]).

	Polymethyl methacrylate Polymethyl methacrylate is a clear plastic, used as a shatterproof replacement for glass. It is used in the production of Plexiglas® and Lucite®. Polymethyl methacrylate.is also found in paint. Acrylic "latex" paints often contain polymethyl methacrylate suspended in water. Polymethyl methacrylate is a vinyl polymer, made by free radical vinyl polymerization from the monomer methyl methacrylate. (Source: http://www.psrc.usm.edu/macrog/pmma.htm [as of June 5, 2003]). Monoethanolamine Monoethanolamine is a clear liquid with an ammonia-like smell. It causes eye and skin burns, harmful or fatal if swallowed, may cause dizziness and drowsiness, causes respiratory tract irritation and possibly damage. Chronic exposure to the skin may cause a persistent irritation or dermatitis. Repeated inhalation may cause lung damage. (Source: Material Safety Data Sheet http://www.astrochemicals.com/10129.pdf [as of June 5, 2003]).

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Deseret Test Center

DTC Test 74-10, Phase II

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of DTC Test 74-10, Phase II was to assess the performance degradation of a marine wing weapons unit in a simulated toxic agent environment. Test objectives were to measure the comparative task efficiency of a nuclear assembly team (NAT) performing identical tasks under normal and simulated toxic conditions; to provide ground and vapor contamination levels that corresponded to expected levels found in a toxic rain attack; to measure contamination on the bomb dummy unit E6 (BDU-E6) and related equipment to determine if decontamination of the weapon was necessary; to determine whether the NAT contaminated the interior of the short airfield tactical protected shelters (SATS) with agent from contaminated protective clothing; and to determine the extent of loss of dimethylmethylphosphonate through evaporation with time.

Dimethylmethylphosphonate thickened with 2.3 percent polymethylmethacrylate and dyed with 0.5 percent oil red dye was used to simulate thickened Soman.

The thickened dimethylmethylphosphonate was disseminated using three pneumatic atomization nozzles mounted in a line.

The decontaminant used was a 10 percent solution of monoethanolamine in water with 0.3 percent Van Waters and Rogers 9N9 nonionic surfactant. One M12A1 power-driven decontamination apparatus was used to apply the decontamination solution to the SATS and the BDU-E6 training weapon.

DTC Test 74-10, Phase II, consisting of seven trials, was conducted in April and May 1974 at Dugway Proving Ground, Utah.

Test Name	DTC Test 74-10, Phase II
Testing Organization	US Army Dugway Proving Ground, Utah
Test Dates	April – May 1974
Test Location	Dugway Proving Ground, Utah
Test Operations	DTC Test 74-10, Phase II consisted of seven trials. Thickened dimethylmethylphosphonate was disseminated using three pneumatic atomization nozzles mounted in a line.
Participating Services	US Army Dugway Proving Ground and US Marine Corps personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Thickened dimethylmethylphosphonate was disseminated using three pneumatic atomization nozzles mounted in a line.
Agents, Simulants, Tracers	Dimethylmethylphosphonate Polymethylmethacrylate
Ancillary Testing	Not identified
Decontamination	One M12A1 power-driven decontamination apparatus (PDDA) was used to apply the monoethanolamine decontamination solution to the SATS and the BDU-E6 training weapon.
Potential Health Risks Associated with Agents, Simulants, Tracers	Dimethylmethylphosphonate Dimethylmethylphosphonate is used as a flame retardant, a preignition additive for gasoline, an antifoam agent, a plasticizer and stabilizer, a textile conditioner and antistatic agent, and an additive for solvents and low-temperature hydraulic fluids. May be harmful if inhaled, swallowed or absorbed through the skin. It is a suspected carcinogen. (Sources: http://ntp-server.niehs.nih.gov/htdocs/LT-studies/

tr323.html and http://physchem.ox.ac.uk/MSDS/DI/diemthyl_methylphosphonate.html [as of June 5, 2003]).

Polymethyl methacrylate

Polymethyl methacrylate is a clear plastic, used as a shatterproof replacement for glass. It is used in the production of Plexiglas® and Lucite®. Polymethyl methacrylate is also found in paint. Acrylic "latex" paints often contain polymethyl methacrylate suspended in water. Polymethyl methacrylate is a vinyl polymer, made by free radical vinyl polymerization from the monomer methyl methacrylate. (Source: http://www.psrc.usm.edu/macrog/pmma.htm [as of June 5, 2003]).

Monoethanolamine

Monoethanolamine is a clear liquid with an ammonia-like smell. It causes eye and skin burns, harmful or fatal if swallowed, may cause dizziness and drowsiness, causes respiratory tract irritation and possibly damage. Chronic exposure to the skin may cause a persistent irritation or dermatitis. Repeated inhalation may cause lung damage. (Source: Material Safety Data Sheet http://www.astrochemicals.com/10129.pdf [as of June 5, 2003]).

Cancellation Analysis

DTC Test 68-14, Channel Crab

Channel Crab was originally planned as a live agent test, using both CS and sarin, to determine the effectiveness of CW agents in the sea-land interface in temperate fog.[1] It was originally prioritized as 10th of 16 planned FY 68 tests in September 1966.[2] There is no further mention of the test in later DTC reports. However, in April 1972, this same test objective was listed in official documentation as satisfied by Study 71-112 and Test 69-33, Phase I.[3,4] The test is therefore presumed to have been cancelled.

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[1] Supplement 2 to the Outline Plans for Testing in FY 68, Jan 67, p. 17.
[2] Summary Report of Fifth Annual Deseret Test Center Planning Conference, 23 Sep 66, pp. 4, 10-11.
[3] Report of the Tenth Annual DTC CINCS/Services Coordination Conference, 18-19 Apr 72, pp. III-2 and III-3.
[4] DHSD investigators previously determined reported that DTC Test 69-33 was cancelled. Interview of the test's test officer on 19 March 2003 revealed that a "shake-out" cruise was conducted for that test off the coast of Eureka, CA in November 1969. With President Nixon's renunciation of the US biological weapons program on 25 November 1969, the test was suspended and no formal test report was published. This reference to Test 69-33, Phase I is to unpublished notes.

Cancellation Analysis

DTC Test 69-74, Prairie Carpet

Originally, data to be gathered in the execution from Prairie Carpet was considered essential in the execution of a later planned test, DTC Test 70-74.[1] Delays in executing Prairie Carpet subsequently delayed the execution of DTC Test 70-74.[2] Documentation from a year later indicates that the microthread technology was tested at Fort Detrick under the 69-74 number and that a preliminary report was published in September 1969.[3] Efforts to locate this report have been unsuccessful, however the microthread technique is the method used to conduct DTC Test 70-74.[4] It is an enclosed method. Prairie Carpet is therefore presumed to have been conducted not as largescale test, but rather as a laboratory test and thus is listed as cancelled.

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[1] Proposed DTC FY 70 Test Plans, Sep 68, p. 161.
[2] Summary Report of the Proceedings of the Eighth Annual Deseret Test Center Planning Conference, 3 Jul 69, pp. 3.
[3] Annual Status Report of Joint Operational Activities, Deseret Test Center, Jul 70, p. 30.
[4] *See* DTC Test 70-74 Fact Sheets

Cancellation Analysis

DTC Test 70-D

In 1968 the North American Air Defense Command (NORAD) submitted a requirement to the Deseret Test Center to "determine the effectiveness of disseminating pathogenic microorganisms in either dry or wet form from a single or multiple line source at altitudes of 20-50 thousand feet in low temperatures".[1] The requirement was based on NORAD observations of Soviet bomber aircraft with heated bomb bays making flights at altitudes of 20,000 to 50,000 feet approximately 300 miles off the west coast of North America. Primary consideration was given to the vulnerability of the North American continent to a biological attack originating 300 miles off the west coast at high altitude.[2] Two contractors, each well-noted in the field of diffusion meteorology, analyzed the effectiveness of disseminating pathogenic microorganisms at high altitude. The results were subjected to a critical in-house analysis by the Deseret Test Center.[3] Analysis led a consensus judgement that a high altitude release of biological warfare materials would pose no significant or predictable threat.[4] It was further concluded that additional research to refine this position would be of little value.[5] No actual high altitude release of biological simulant was conducted and NORAD's requirement was considered closed.

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[1] Letter, North American Air Defense Command, Ent AFB, CO, 19 June 1968, subject: NORAD Chemical Test Requirements (U).
[2] High Altitude Release, Special Study in Support of DTC Test 70-D, August 1972, p.1-1.
[3] High Altitude Release, Special Study in Support of DTC Test 70-D, August 1972, p.iii.
[4] High Altitude Release, Special Study in Support of DTC Test 70-D, August 1972, p.iii.
[5] High Altitude Release, Special Study in Support of DTC Test 70-D, August 1972, p.1-1.

Cancellation Analysis

DTC Tests 71-10, 71-11, 71-12, 71-13, 71-30, 71-31, 71-32, 71-33, 71-34, 71-35 and 71-70

DTC Tests 71-10, 71-11, 71-12, 71-13, 71-30, 71.31, 71-32, 71-33, 71-34, 71-35 and 71-70 were last mentioned in DTC planning documentation in March 1969.[1] The last seven tests were biological tests and would have been impacted by President Nixon's renunciation of the US biological weapons program on November 25, 1969. In late June 1971, in opening remarks at DTC's next annual planning conference (held over two years later), Commanding General, BG Etkin noted that the command's activities had decreased from seven "safari" tests conducted in FY 69 to just one joint test in FY 71.[2] Until 1976, fiscal years ran from 1 July of the previous year to 30 June of the fiscal year. BG Etkin therefore made his statement in the waning days of FY 71. DTC Test 70-73 was conducted from July through December 1970, at the beginning of FY 71, and is thus the one joint test conducted that fiscal year. DTC Tests 71-10, 71-11, 71-12, 71-13, 71-30, 71-31, 71-32, 71-33, 71-34, 71-35 and 71-70 are therefore presumed to have been cancelled.

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[1] Summary Report of the Proceedings of the Eighth Annual Deseret Test Center Planning Conference, 3 Jul 69, Appendix 4.

[2] Report of the Ninth Annual DTC CINC/Services CB Coordination Conference, 22-24 June 1971, p. 1.

Cancellation Analysis

DTC Test 71-75

DTC Test 71-75 was designed to evaluate the integrity of the chemical and biological defense systems of several critical CONUS national security sites. Originally planned as part of the FY 71 testing program, it was carried over to the FY 72 program.[1] This is confirmed by the test's listing as the method of satisfying requirements CO-6 and SA-1 in a June 1971 planning document.[2] By March 1972, these requirements are listed in FY 74 planning documents as having been satisfied by two phases of study 71-160.[3] DTC Test 71-75 is therefore presumed to have been cancelled.

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[1] DTC Program for FY 72, Mar 71, p. 9.
[2] Report of the Ninth Annual DTC CINCS/Services CB Coordination Conference, 22-24 June 1971, pp. 3-10 and 3-12.
[3] Deseret Test Center Outline Plans for FY 74, Mar 72, pp. 102 and 108.

CANCELLATION ANALYSIS

DTC Test 72-30 (SHAD)

DTC Test 72-30 was designed to gather data to further characterize biological aerosol diffusion in a marine environment.[1] As of the end of calendar year 1972, the test, also known under the revised research and development program as T400N, had been deferred pending approval from "higher headquarters."[2] Conduct of this test would have also required reconstitution of a testing fleet since the USS Granville S. Hall (YAG-40) had been sold by the Marine Administration on 31 Jan 72. The Deseret Test Center, headquartered at Fort Douglas, Utah, closed in 1973, before DTC Test 72-30 could be conducted; the test is therefore presumed to have been cancelled.

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[1] Deseret Test Center Outline Planes for FY 75, Feb 73, p. 7.

[2] Semiannual Status report, 1 Jul - 31 Dec 72, Deseret Test Center, Jan 73, p. 4.

Cancellation Analysis

DTC Test 72-70 (SHAD)

DTC Test 72-70 was designed to determine the vulnerability of coastal targets to offshore biological attack.[1] As of the end of calendar year 1972, the test, also known under the revised research and development program as T405N, had been deferred pending approval from "higher headquarters."[2] It is unclear whether conduct of this test would have required reconstitution of at least a portion of the previous Project SHAD fleet. Such an effort would have been hampered by the Marine Administration's 31 Jan 72 sale of the USS Granville S. Hall (YAG-40). The Deseret Test Center, headquartered at Fort Douglas, Utah, closed in 1973, before DTC Test 72-70 could be conducted; the test is therefore presumed to have been cancelled.

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[1] Deseret Test Center Outline Planes for FY 75, Feb 73, p. 7.

[2] Semiannual Status report, 1 Jul - 31 Dec 72, Deseret Test Center, Jan 73, p. 4.

Cancellation Analysis

DTC Test 73-11

DTC Test 73-11 was designed in response to Air Force and Pacific Command requirements, AF-6 and PA-11, to validate procedures for emergency destruction of MC-1 and TMU/28/B weapons. According to DTC FY 74 planning documentation, DTC Test 73-11 was projected to address these requirements in FY 73.[1] FY 75 planning documentation pushed this to FY 74. There was also a parenthetical notation that DTC Test 73-11 fell under the revised research and development program I110F that included emergency weapons disposal.[2] The Deseret Test Center, headquartered at Fort Douglas, Utah, closed in 1973, before DTC Test 73-11 could be conducted; the test is therefore presumed to have been cancelled.

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[1] Deseret Test Center Outline Plans for FY 74, Mar 72, pp. 100 and 107.
[2] Deseret Test Center Outline Plans for FY 75, Feb 73, pp. 34 and 40.

Cancellation Analysis

DTC Test 73-12

DTC Test 73-12 was designed in response to a Pacific Command requirement to determine the effectiveness of air delivered flame weapons, such as flame drum drops or napalm, to clear mine fields and booby traps.[1] In March 1972, the test was still listed as planned for execution in FY 73 to fulfill requirement PA-10.[2] The following month, there was discussion at the annual DTC planning conference that work already being done at the US Army Mobility Equipment Research and Design Center at Fort Belvoir, VA with the CBU-55 might satisfy the requirement.[3] Less than a year later, plans for FY 75 do not mention DTC Test 73-12, but do indicate that requirement PA-10 has been satisfied by "the forthcoming MERDC CBU-55 Testing Report."[4,5] Test 73-12 is therefore presumed to have been cancelled.

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[1] Deseret Test Center Requirements and Proposed Program for FY73, Oct 71, p. 47.
[2] Deseret Test Center Outline Plans for FY74, Mar 72, p. 10.
[3] Report of the Tenth Annual DTC CINCS/Services CB Coordination Conference, 18-19 Apr 1972, p. 14.
[4] Deseret Test Center Outline Plans for FY75, Feb 73, p. 40.
[5] This test was documented in MERDC Test Report 2056, DTIC Accession Number AD0524999, 1 Mar 73.

Cancellation Analysis

DTC Test 74-030

DTC Test 74-030 was designed in response to Army and Navy requirements, AR-6 and NA-5, to determine biological effects in a variety of environments. Initial FY 74 planning documentation indicated that it would be executed in FY 74 as a follow-on to DTC Test 70-74.[1] FY 75 planning documentation added the parenthetical notation that DTC Test 74-030 fell under the revised research and development program T410A that included effects of environmental factors on biological decay. It further indicated that work would continue into FY 75.[2] The Deseret Test Center, headquartered at Fort Douglas, Utah, closed in 1973, before DTC Test 74-030 could be conducted; the test is therefore presumed to have been cancelled.

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[1] Deseret Test Center Outline Plans for FY 74, Mar 72, pp. 95 and 97.
[2] Deseret Test Center Outline Plans for FY 75, Feb 73, pp. 30 and 32.